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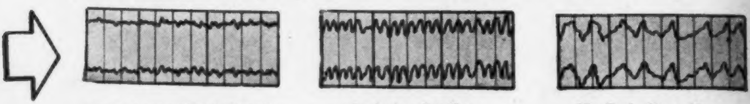

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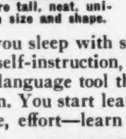

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EDITORIAL

HYPERDEMOCRACY

SO FAR as I can make out, there is such a thing as an excess of anything you can name. There's the old gag that you can get drunk on water . . . just as you can on land. But it's also true that you can become intoxicated by too much water. Hard to do, of course, but it's a medical fact. Too much oxygen can produce quite a tizzy, too.

Too much truth, unmodified by good sense and understanding, can be destructive, also. The "catty" woman frequently uses truth as her weapon to hurt.

I rather imagine the following comments are going to call forth howls of wrath from a good many sources. Nevertheless, I feel that they constitute painful truths that need to be examined.

I propose for debate the proposition: "The United States is suffering from an acute attack of excessive democracy."

First, it needs to be determined whether or not there can be such a thing as an excess of democracy—too much equality.

The original purpose of the democratic concept was to establish the value of the individual—the right of the Freeman individual to think for himself, and to work for himself, as against the older concept of the individual as an entity owned by the state. The original intent of democracy was to allow the individual to achieve the full development of his individual potentials, unlimited by such arbitraries as aristocracy-of-birth, or other arbitrarily imposed restrictions. That all men were to have equal opportunity to develop their own valuable potentials.

In hyperdemocracy, however, the democratic concept is subtly, and malignantly, shifted to hold that all men should *be* equal—that *individually achieved* developments should be equal.

This is *not* the same thing as equality of opportunity, since it actually imposes an arbitrary limitation on the right of the individual to achieve his maximum potentials.

Equality of opportunity, however, is exceedingly hard to demonstrate!

Suppose two individuals. Tom and Dick, are given equal opportunity to develop their individual abilities. Tom winds up a millionaire, and Dick winds up on a skimpy retirement pay. The objective evidence clearly shows that Tom and Dick did not have equal opportunity, doesn't it?

Yes, it does. Tom had superior opportunities; he had the gift of learning very rapidly, so that, exposed to the same information sources, and the same situations Dick was, Tom learned fifteen times as much. Tom, going to the same school Dick did, learned that Columbus discovered America . . . and that Leif Ericson probably landed in Laborador five or six centuries earlier. That various French and Spanish pioneers explored the area of the western United States, but that the Lewis and Clark expedition was more important.

And Dick, having answered the school examinations properly, knew that he had learned what the proper citizen was supposed to learn.

But Tom, having answered the school examinations the same way Dick did, learned something quite different. "It doesn't do much good to open a pathway if people don't want to go there. There's no point in discovering a continent until people need a new continent. There's no use exploring a new territory until people are present to move in, and want a new territory to move into." That was a great help to Tom

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in later life, when he was organizing the companies and enterprises that made his millions.

Dick had the same opportunities to learn . . . but Tom had an unfair, arbitrary opportunity not given Dick. Something *not* education, but inherent, gave Tom a greater ability to learn from any data offered him.

In hyperdemocracy, inequality of results is considered proof of inequality of opportunity. Inequality of what level of opportunity? Is innate, God-given ability undemocratic? Something to be suppressed, punished, ground out, so that we can have absolute equality?

But this isn't democracy! Democracy implies giving each free individual the right to develop his own talents as best he may—so long as those talents are not destructive to others. (Talented assassins will be suppressed, of course.)

To hold that results must be equal is to violate the central intent of true democracy—that each individual shall have equal opportunity to develop his abilities.

A hyperdemocracy, if such existed, would have the characteristic of seeking to force individuals to conform to an arbitrary norm—neither rising above the "proper" level, nor allowing them to lag below. It would seek to punish individuals who advanced beyond the norm—who showed "undemocratic" superiority of actual ability. It would confuse superior *ability* with superior *opportunity*. It would insist that no individual had any right to marked superiority of achievement—that the true proof of democratic equality of opportunity was equality of results. That innate difference did not, and of a right should not, exist. That anyone who claimed innate differences did exist was undemocratic—and that anyone who demonstrated that such differences existed was criminally undemocratic, and should be punished for his anti-democratic actions.

Lopsided superiority, with compensating hopeless deficiencies, would be tolerable, of course. A Steinmetz, a brilliant cripple, wouldn't be anti-democratic, because, of course, his physical deformity makes him average out not-superior. The genius must be crippled, one way or another, either physically, or mentally, or he is unacceptable in a hyperdemocratic concept. The brilliant scientist must be an odd-ball of some sort, or he's unacceptable. To suggest that individuals exist who are genuinely, innately superior is, in the hyperdemocratic concept, intolerable.

And I'm defying every rule of our present hyperdemocracy by bringing these propositions into the open. I'm suggesting that there are human beings who have innate, unmatchable-by-education talents of genuine superiority that you haven't got a prayer of achieving—things that neither training, practice, education, or anything else can ever give you or me.

First: A hemophiliac bleeds by reason of a genetic anomaly. It's not due to training, education, or lack of opportunity to learn something. You don't have that defect. Then, with respect to the hemophiliac you have an innate superiority, due to genetic difference—and it is unarguably a survival superiority.

You didn't earn that superiority; it was given you by your ancestors. (They, one might say, earned it.)

In the same way, a Peruvian Indio can play football at 15,000 foot elevation. You can't. Even if you trained for five years, you still wouldn't have the fundamental biochemical adaptations that generations of selective breeding have given the Peruvian. He can use a lower oxygen-tension, and get successful displacement of the CO_2 from his blood. You can't; you never will be able to. It's not learnable. I can't, and don't kid myself that I can.

I saw an article on the biochemical adaptations of the Peruvian Indios in the *Scientific American* a couple of years ago; it was a fine piece of objective reporting . . . down to the last paragraph. In that, the researcher felt forced to specifically state that it was not proper to conclude that it was a genetic superiority—that, in fact, any human baby born and raised at 15,000 foot altitudes would undoubtedly display the same type of adaptation.

That last statement is no doubt true. Their tests showed that an American engineer who'd been living at 14,000 feet for many years was able to perform on their treadmill for only eight minutes; their Indio subjects had worked on it for as long as ninety minutes. If a man in excellent health, after years of adaptation, could manage only eight minutes of work on the treadmill—could a woman survive the period of labor in childbirth? Conclusion: undoubtedly a child born and raised at that altitude would show the Peruvian Indio adaptations. He'd *be* a Peruvian Indio; no woman of other racial stock without those adaptations could bear a child there.

What made the scientist who did that report add that gratuitous—and invalid!—statement that the data did not indicate an innate superiority of altitude adaptation?

In a hyperdemocracy, we don't acknowledge innate differences not correctable by education and training. Not even if we've found one . . . unless we want to raise the wrath of misguided super-democrats. And universities don't, these days, like to annoy the populace.

(How long has it been since an American University raised a real, angry debate by a firm, open statement contrary to popular ideology? The only time our modern, remarkably spineless Universities get into controversies is when they get caught in a squeeze between two opposed groups of the populace. The conflicts are never of their own doing! The Universities that were, once, the leaders of thought are, today, remarkable for their fast footwork in following public opinion trends.)

It's a self-evident fact that mam-

(*Continued on page* 159)

WE HAVE FED OUR SEA

BY POUL ANDERSON

First of Two Parts. Perhaps the deadest of all things possible in this Universe is the dead cold core of a burned-out supernova. But Death is, of course, the ultimate trap of all living things!

Illustrated by van Dongen

THEY named her *Southern Cross* and launched her on the road whose end they would never see. Months afterward she was moving at half the speed of light; if there was to be enough reaction mass for deceleration and maneuver, the blast must be terminated. And so the long silence came. For four and a half centuries, the ship would fall.

They manned her by turns, and dreamed other ships, and launched them, and saw how a few of the shortest journeys ended. Then they died.

And other men came after them. Wars flamed up and burned out, the howling peoples dwelt in smashed cities and kindled their fires with books. Conquerors followed, and conquerors of those, an empire killed its mother aborning, a religion called men to strange hilltops, a new race and a new state bestrode the Earth. But still the ships fell upward through night, and always there were men to stand watch upon them. Sometimes the men wore peaked

caps and comets, sometimes steel helmets, sometimes decorous gray cowls, eventually blue berets with a winged star; but always they watched the ships, and more and more often as the decades passed they brought their craft to new harbors.

After ten generations, the *Southern Cross* was not quite halfway to her own goal, though she was the farthest from Earth of any human work. She was showing a little wear, here a scratch, there a patch, and not all the graffiti of bored and lonely men rubbed out by their successors. But those fields and particles which served her for eye, brain, nerve still swept heaven; each man at the end of his watch took a box of microplates with him as he made the hundred light-year stride to Earth's Moon. Much of this was lost, or gathered dust, in the century when Earthmen were busy surviving. But there came a time when a patient electrically seeing machine ran through many such plates from many ships. And so it condemned certain people to death.

I

Sundown burned across great waters. Far to the west, the clouds banked tall above New Zealand threw hot gold into the sky. In that direction, the sea was too bright to look upon. Eastward it faded through green and royal blue to night, where the first stars trod forth and trembled. There was just enough wind to ruffle the surface, send wavelets lapping against the hull of the ketch, flow down the idle mainsail and stir the girl's loosened pale hair.

Terangi Maclaren pointed north. "The kelp beds are that way," he drawled. "Main source of the family income, y' know. They mutate, crossbreed, and get seaweed which furnishes all kind of useful products. It's beyond me, thank the honorable ancestors. Biochemistry is an organized mess. I'll stick to something simple, like the degenerate nucleus."

The girl giggled. "And if it isn't degenerate, will you make it so?" she asked.

She was a technic like himself, of course: he would never have let a common on his boat, since a few machines were, in effect, a sizable crew. Her rank was higher than his, so high that no one in her family worked productively—whereas Maclaren was one of the few in his who did not. She was of a carefully selected mutant Burmese strain, with amber skin, exquisite small features, and greenish-blond hair. Maclaren had been angling for weeks to get her alone like this. Not that General Feng, her drug-torpid null of a guardian, cared how much scandal she made, flying about the planet without so much as an amazon for chaperone. But she was more a creature of the Citadel and its hectic lights than of the sunset ocean.

Maclaren chuckled. "I wasn't swearing at the nucleus," he said. "Degeneracy is a state of matter under certain extreme conditions. Not too well understood, even after three hundred years of quantum theory. But I wander, and I would rather wonder. At you, naturally."

He padded barefoot across the deck and sat down by her. He was a tall man in his early thirties, slender, with wide shoulders and big hands, dark-haired and brown-skinned like all Oceanians; but there was an aquiline beak on the broad high-cheeked face, and some forgotten English ancestor looked out of hazel eyes. Like her, he wore merely an informal sarong and a few jewels.

"You're talking like a scholar, Terangi," she said. It was not a compliment. There was a growing element in the richest families who found Confucius, Plato, Einstein, and the other classics a thundering bore.

"Oh, but I am one," said Maclaren. "You'd be amazed how parched and snuffy I can get. Why, as a student—"

"But you were the amateur swim-wrestling champion!" she protested.

"True. I could also drink any two men under the table and knew every dive on Earth and the Moon. However, d' you imagine my father, bless his dreary collection of old-fashioned virtues, would have subsidized me all these years if I didn't bring some credit to the family? It's kudos, having an astrophysicist for a son. Even if I am a rather expensive astrophysicist." He grinned through the gathering dusk. "Every so often, when I'd been on a particularly outrageous binge, he would threaten to cut my allowance off. Then I'd have no choice but to come up with a new observation or a brilliant new theory, or at least a book."

She snuggled a little closer. "Is that why you are going out to space now?" she asked.

"Well, no," said Maclaren. "That's purely my own idea. My notion of fun. I told you I was getting stuffy in my dotage."

"We haven't seen you very often in the Citadel, the last few years," she agreed. "And you were so busy when you did show."

"Politics, of a sort. The ship's course couldn't be changed without an order from a reluctant Exploration Authority, which meant bribing the right people, heading off the opposition, wheedling the Protector himself . . . d' you know, I discovered it was fun. I might even take up politics as a hobby, when I get back."

"How long will you be gone?" she asked.

"Can't say for certain, but probably just a month. That ought to furnish me with enough material for several years of study. Might dash back to the ship at odd moments for the rest of my life, of course. It'll take up permanent residence around that star."

"Couldn't you come home . . . every night?" she murmured.

"Don't tempt me," he groaned. "I can't. One month is the standard minimum watch on an interstellar vessel, barring emergencies. You see, every transmission uses up a Frank tube, which costs money."

"Well," she pouted, "if you think so much of an old dead star—"

"You don't understand, your gorgeousness. This is the first chance anyone has ever had, in more than two centuries of space travel, to get a close look at a truly burned-out star. There was even some argument whether the class existed. Is the universe old enough for any sun to have used up its nuclear *and* gravitational energy? By the ancestors, it's conceivable this one is left over from some previous cycle of creation!"

He felt a stiffening in her body, as if she resented his talk of what she neither understood nor cared about. And for a moment he resented her. She didn't really care about this boat either, or him, or anything except her own lovely shell. Why was he wasting time in the old worn routines, when he should be studying and preparing? He knew precisely why.

And then her rigidity melted in a little shudder. He glanced at her, she was a shadow with a palely glowing mane, in the deep blue twilight. The last embers of sun were almost gone, and one star after another woke overhead, soon the sky would be crowded with their keenness.

Almost, she whispered: "Where is this spaceship, now?"

A bit startled, he pointed at the first tracing of the Southern Cross. "That way," he said. "She was originally bound for Alpha Crucis, and hasn't been diverted very far off that course. Since she's a good thirty parsecs out, we wouldn't notice the difference if we could see that far."

"But we can't. Not ever. The light would take a hundred years, and I . . . we would all be dead— No!"

He soothed her, a most pleasant proceeding which became still more pleasant as the night went on. And they were on his yacht, which had borne his love from the first day he took the tiller, in a calm sea, with wine and small sandwiches, and she even asked him to play his guitar and sing. But somehow it was not the episode he had awaited. He kept thinking of this or that preparation, what had he overlooked, what could he expect to find at the black sun; perhaps he was indeed under the subtle tooth of age, or of maturity if you wanted a euphemism, or perhaps the Southern Cross burned disturbingly bright overhead.

II

Winter lay among the Outer Hebrides. Day was a sullen glimmer between two darknesses, often smothered in snow. When it did not fling itself upon the rocks and burst in freezing spume, the North Atlantic rolled in heavy and gnawing. There was no real horizon, leaden waves met leaden sky and misty leaden light hid the seam. "Here there is neither land nor water nor air, but a kind of mixture of them," wrote Pytheas.

The island was small. Once it had held a few fishermen, whose wives kept a sheep or two, but that was long ago. Now only one house remained, a stone cottage built centuries back and little changed. Down at the landing was a modern shelter for a sailboat, a family submarine, and a battered aircar; but it was of gray plastic and fitted into the landscape like another boulder.

David Ryerson put down his own hired vehicle there, signaled the door to open, and rolled through. He had not been on Skula for half a decade: it touched him, in a way, how his hands remembered all the motions of steering into this place and how the dank interior was unaltered. As for his father— He bit back an inward fluttering, helped his bride from the car, and spread his cloak around them both as they stepped into the wind.

It howled in from the Pole, striking them so they reeled and Tamara's black locks broke free like torn banners. Ryerson thought he could almost hear the wind toning in the rock underfoot. Surely the blows of the sea did, crash after crash through a bitter drift of flung scud. For a moment's primitive terror, he thought he heard his father's God, whom he had denied, roar in the deep. He fought his way to the cottage and laid numbed fingers on the anachronism of a corroded bronze knocker.

Magnus Ryerson opened the door and waved them in. "I'd not expected you yet," he said, which was as close as he would ever come to an apology. When he shut out the wind, there was a quietness which gaped.

This main room, brick-floored, whitewashed, irregular and solid, centered about a fireplace where peat burned low and blue. The chief concessions to the century were a radiglobe and a stunning close-up photograph of the Sirian binary. One did not count the pilot's manuals or the stones and skins and gods brought from beyond the sky; after all, any old sea captain would have kept his Bowditch and his souvenirs. The walls were lined with books as well as microspools. Most of the full-size volumes were antique, for little was printed in English these days.

Magnus Ryerson stood leaning on a cane of no Terrestrial wood. He was a huge man, two meters tall in his youth and not greatly stooped now, with breadth and thickness to match. His nose jutted craggily from a leather skin, shoulder-length white hair, breast-length white beard. Under tangled brows, the eyes were small and frost-blue. He wore the archaic local dress, a knitted sweater and canvas trousers. It came as a shock to realize after several minutes that his right hand was artificial.

"Well," he rumbled at last, in fluent Interhuman, "so this is the bride. Tamara Sumito Ryerson, eh? Welcome, girl." There was no great warmth in his tone.

She bent her face to folded hands. "I greet you most humbly, honorable father." She was Australian, a typical high-class common of that province, fine-boned, bronze-hued, with blue-black hair and oblique brown eyes; but her beauty was typical nowhere. She had dressed with becoming modesty in a long white gown and a hooded cloak, no ornaments save a wedding band with the Ryerson monogram on it.

Magnus looked away from her, to his son. "Professor's daughter, did you say?" he murmured in English.

"Professor of symbolics," said David. He made his answer a defiance by casting it in the Interhuman which his wife understood. "We . . . Tamara and I . . . met at his home. I needed a background in symbolics to understand my own specialty and—"

"You explain too much," said Magnus dryly. "Sit."

He lowered himself into a chair. After a moment, David followed. The son was just turned twenty years old, a slender boy of average height with light complexion, thin sharp features, yellow hair, and his father's blue eyes. He wore the tunic of a science graduate, with insignia of gravitics, self-consciously, but not so used to it that he would change for an ordinary civilian blouse.

Tamara made her way into the kitchen and began preparing tea. Magnus looked after her. "Well-trained, anyhow," he grunted in English. "So I suppose her family is at least heathen, and not any of these latter-day atheists. That's somewhat."

David felt the island years, alone with his widower father, return to roost heavy upon him. He stifled an anger and said, also in English: "I couldn't have made any better match. Even from some swinish practical standpoint. Not without marrying into a technic family, and— Would you want me to do that? I'll gain technic rank on my own merits!"

"If you stay on Earth," said Magnus. "Who notices a colonial?"

"Who notices an Earthling, among ten billion others?" snapped David. "On a new planet . . . on Rama . . . a man can be himself. These stupid hereditary distinctions won't even matter."

"There is room enough right here," said Magnus. "As a boy you never used to complain Skula was crowded. On the contrary!"

"And I would settle down with some illiterate beefy-faced good Christian fishwife you picked for me and breed more servants for the Protectorate, all my life!"

The words had come out before David thought. Now, in a kind of dismay, he waited for his father's reaction. This man had ordered him out into a winter gale, or supperless to bed, for fifteen years out of twenty. In theory the grown son was free of him, free of everyone save contractual overlords and whatever general had most recently seized the title of Protector. In practice it was not so easy. David knew with a chill that he would never have decided to emigrate without Tamara's unarrogant and unbendable will to stiffen his. He would probably never even have married her, without more than her father's consent, against the wish of his own—David gripped the worn arms of his chair.

Magnus sighed. He felt about after

a pipe and tobacco pouch. "I would have preferred you to maintain residence on Earth," he said with a somehow shocking gentleness. "By the time the quarantine on Washington 5584 has been lifted, I'll be dead."

David locked his mouth. *You hoary old fraud,* he thought, *if you expect to hook me that way—*

"It's not as if you would be penned on one island all your days," said Magnus. "Why did I spend all I had saved, to put my sons through the Academy? So they could be spacemen, as I was and my father and grandfather before me. Earth isn't a prison. The Earthman can go as far as the farthest ships have reached. It's the colonies are the hole. Once you go there to live, you never come back here."

"Is there so much to come back to?" said David. Then, after a minute, trying clumsily for reconciliation: "And father, I'm the last. Space ate them all. Radiation killed Tom, a meteor got Ned, Eric made a falling star all by himself, Ian just never returned from wherever it was. Don't you want to preserve our blood in me, at least?"

"So you mean to save your own life?"

"Now, wait! You know how dangerous a new planet can be. That's the reason for putting the initial settlers under thirty years of absolute quarantine. If you think I—"

"No," said Magnus. "No, you're no coward, Davy, where it comes to physical things. When you deal with people, though . . . I don't know what you're like. You don't yourself. Are you running away from man, as you've been trying to run from the Lord God Jehovah? Not so many folk on Rama as on Earth; no need to work both with and against them, as on a ship— Well." He leaned forward, the pipe smoldering in his plastic hand. "I want you to be a spaceman, aye, of course. I cannot dictate your choice. But if you would at least try it, once only, so you could honestly come back and tell me you're not born for stars and openness and a sky all around you— Do you understand? I could let you go to your planet then. Not before. I would never know, otherwise, how much I had let you cheat yourself."

Silence fell between them. They heard the wind as it mourned under their eaves, and the remote snarling of the sea.

David said at last, slowly: "So that's why you . . . yes. Did you give my name to Technic Maclaren for that dark star expedition?"

Magnus nodded. "I heard from my friends in the Authority that Maclaren had gotten the *Cross* diverted from orbit. Some of them were mickle put out about it, too. After all, she was the first one sent directly toward a really remote goal, she is farther from Earth than any other ship has yet gotten, it was like breaking a tradition." He shrugged. "God knows when anyone will reach Alpha Crucis now. But I say Maclaren is right. Alpha may be an interesting triple star, but a truly cold sun means a deal more to science. At any rate, I did pull a few wires. Maclaren needs a gravitics man to help him take his data. The post is yours if you wish it."

"I don't," said David. "How long would we be gone, a month, two months? A month from now I planned to be selecting my own estate on Rama."

"Also, you've only been wed a few weeks. Oh, yes. I understand. But you can be sent to Rama as soon as you get back; there'll be several waves of migration. You will have space pay plus exploratory bonus, some valuable experience, and," finished Magnus sardonically, "my blessing. Otherwise you can get out of my house this minute."

David hunched into his chair, as if facing an enemy.

He heard Tamara move about, slow in the unfamiliar kitchen, surely more than a little frightened of this old barbarian. If he went to space, she would have to stay here, bound by a propriety which was one of the chains they had hoped to shed on Rama. It was a cheerless prospect for her, too.

And yet, thought David, the grim face before him had once turned skyward, on a spring night, telling him the names of the stars.

III

The other man, Ohara, was good, third-degree black. But finally his alertness wavered. He moved in unwarily, and Seiichi Nakamura threw him with a foot sweep that drew approving hisses from the audience. Seeing his chance, Nakamura pounced, got control of Ohara from the waist down by sitting on him, and applied a strangle. Ohara tried to break it, but starving lungs betrayed him. He slapped the mat when he was just short of unconsciousness. Nakamura released him and squatted, waiting. Presently Ohara rose. So did the winner. They retied their belts and bowed to each other. The abbot, who was refereeing, murmured a few words which ended the match. The contestants sat down, closed their eyes, and for a while the room held nothing but meditation.

Nakamura had progressed beyond enjoying victory for its own sake. He could still exult in the aesthetics of a perfect maneuver; what a delightful toy the human body is, when you know how to throw eighty struggling kilos artistically through the air! But even that, he knew, was a spiritual weakness. Judo is more than a sport, it should be a means to an end: ideally, a physical form of meditation upon the principles of Zen.

He wondered if he would ever attain that height. Rebelliously, he wondered if anyone ever had, in actual practice, for more than a few moments anyhow . . . It was an unworthy thought. A wearer of the black belt in the fifth degree should at least have ceased inwardly barking at his betters. And now enough of all the personal. It was only his mind reflecting the tension of the contest, and tension was always the enemy. His mathematical training led him to visualize fields of force, and the human soul as a differential quantity dX—where X was a function of no one knew how many variables—which applied just enough, vanishingly small increments of action so that the great fields slid over each other and— Was this a desirable analogue? He must discuss it with the abbot sometime; it seemed too precise to reflect reality. For now he had better meditate upon one of the traditional paradoxes: consider the noise made by two hands clapping, and then the noise made by *one* hand clapping.

The abbot spoke another word. The several contestants on the mat bowed to him, rose, and went to the showers. The audience, yellow-robed monks and a motley group of townspeople, left their cushions and mingled cheerfully.

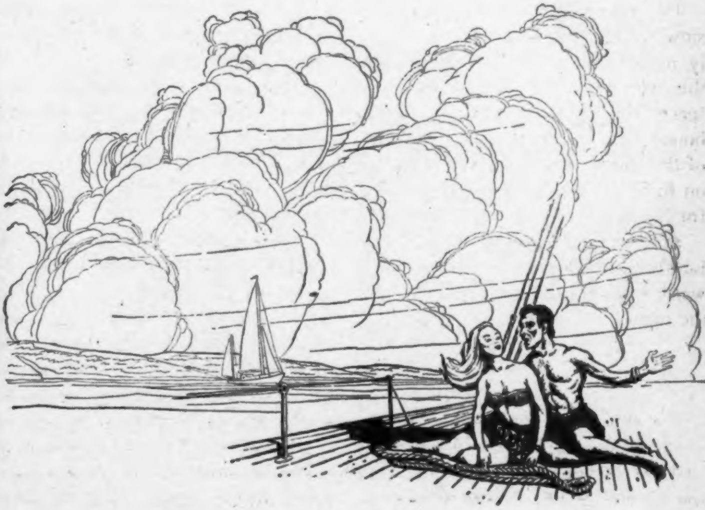
When Nakamura came out, his gi rolled under one arm, his short thickset body clad in plain gray coveralls, he saw the abbot talking to Diomed Umfando, chief of the local Protectorate garrison. He waited until they noticed him. Then he bowed and sucked in his breath respectfully.

"Ah," said the abbot. "A most admirable performance tonight."

"It was nothing, honorable sir," said Nakamura.

"What did you . . . yes. Indeed. You are leaving tomorrow, are you not?"

"Yes, master. On the *Southern Cross,* the expedition to the dark star.



It is uncertain how long I shall be away." He laughed self-deprecatingly, as politeness required. "It is always possible that one does not return. May I humbly ask the honorable abbot that—"

"Of course," said the old man. "Your wife and children shall always be under our protection, and your sons will be educated here if no better place can be found for them." He smiled. "But who can doubt that the best pilot on Sarai will return as a conqueror?"

They exchanged ritual compliments. Nakamura went about saying good-by to various other friends. As he came to the door, he saw the tall blue-clad form of Captain Umfando. He bowed.

"I am walking back into town now," said the officer, almost apologetically. "May I request the pleasure of your company?"

"If this unworthy person can offer even a moment's distraction to the noble captain?"

They left together. The dojo was part of the Buddhist monastery, which stood two or three kilometers out of the town called Susa. A road went through grainfields, an empty road now, for the spectators were still drinking tea under the abbot's red roof. Nakamura and Umfando walked in silence for a while; the captain's bodyguard shouldered their rifles and followed unobtrusively.

Capella had long ago set. Its sixth planet, Il-Khan the giant, was near full phase, a vast golden shield blazoned with a hundred hues. Two other satellites, not much smaller than this Earth-sized Sarai on which humans dwelt, were visible. Only a few stars could shine through all that light, low in the purple sky; the fields lay drowned in amber radiance, Susa's lanterns looked feeble in the distance. Meteor trails crisscrossed heaven, as if someone wrote swift ideographs up there. On the left horizon, a sudden mountain range climbed until its peaks burned with snow. A moonbird was trilling, the fiddler insects answered, a small wind rustled in the grain. Otherwise only the scrunch of feet on gravel had voice.

"This is a lovely world," murmured Nakamura.

Captain Umfando shrugged. Wryness touched his ebony features. "I could wish it were more sociable."

"Believe me, sir, despite political differences, there is no ill will toward you or your men personally—"

"Oh, come now," said the officer. "I am not that naïve. Sarai may begin by disliking us purely as soldiers and tax collectors for an Earth which will not let the ordinary colonist even visit it. But such feelings soon envelop the soldier himself. I've been jeered at, and mudballed by children, even out of uniform."

"It is most deplorable," said Nakamura in distress. "May I offer my apologies on behalf of my town?"

Umfando shrugged. "I'm not certain that an apology is in order. I didn't have to make a career of the Protector's army. And Earth does exploit the colonies. There are euphemisms and excuses, but exploitation is what it amounts to."

He thought for a moment, and asked with a near despair: "But what else can Earth do?"

Nakamura said nothing. They walked on in silence for a while.

Umfando said at last, "I wish to put a rude question." When the flat face beside him showed no reluctance, he plowed ahead. "Let us not waste time on modesty. You know you're one of the finest pilots in the Guild. Any Capellan System pilot is —he has to be!—but you are the one they ask for when things get difficult. You've been on a dozen exploratory missions in new systems. It's not made you rich, but it has made you one of the most influential men on Sarai.

"Why do *you* treat me like a human being?"

Nakamura considered it gravely. "Well," he decided, "I cannot consider politics important enough to quarrel about."

"I see." A little embarrassed, Umfando changed the subject: "I can get you on a military transport to Batu tomorrow, if you wish. Drop you off at the 'caster station."

"Thank you, but I have already engaged passage on the regular intersatellite ferry."

"Uh . . . did you ask for the *Cross* berth?"

"No. I had served a few watches on her, of course, like everyone else. A good ship. A little outmoded now, perhaps, but well and honestly made. The Guild offered me the position, and since I had no other commitments, I accepted."

Guild offers were actually assignments for the lower ranks of spacemen, Umfando knew. A man of Nakamura's standing could have refused. But maybe the way you attained such prestige was by never refusing.

"Do you expect any trouble?" he asked.

"One is never certain. The great human mistake is to anticipate. The totally relaxed and unexpectant man is the one prepared for whatever may happen: he does not have to get out of an inappropriate posture before he can react."

"Ha! Maybe judo ought to be required for all pilots."

"No. I do not think the coerced mind ever really learns an art."

Nakamura saw his house ahead. It stood on the edge of town, half screened by Terrestrial bamboo. He had spent much time on the garden which surrounded it; many visitors were kind enough to call his garden beautiful. He sighed. A gracious house, a good and faithful wife, four promising children, health and achievement, what more could a man reasonably ask? He told himself that his remembrances of Kyoto were hazed, he had left Earth as a very young boy. Surely this serene and uncrowded Sarai offered more than poor tortured antheap Earth gave even to her overlords. And yet some mornings he woke up with the temple bells of Kyoto still chiming in his ears.

He stopped at the gate. "Will you honor my home for a cup of tea?" he asked.

"No, thanks," said Umfando, almost roughly. "You've a family to . . . to say good-by to. I will see you when—"

Fire streaked across the sky. For an instant Il-Khan himself was lost in blue flame. The bolide struck somewhere among the mountains. A sheet of pure outraged energy flared above ragged peaks. Then smoke and dust swirled up like a devil, and moments afterward thunder came banging down through the valley.

Umfando whistled. "That was a monster!"

"A . . . yes . . . most unusual . . . yes, yes." Nakamura stammered something, somehow he bowed good night and somehow he kept from running along the path to his roof. But as he walked, he began to shake.

It was only a meteorite, he told himself frantically. Only a meteorite. The space around a giant star like Capella, and especially around its biggest planet, was certain to be full of cosmic junk. Billions of meteors hit Sarai every day. Hundreds of them got through to the surface. But Sarai was as big as Earth, he told himself. Sarai had oceans, deserts, uninhabited plains and forests . . . why, even on Sarai you were more likely to be killed by lightning than by a meteorite and—and—

Oh, the jewel in the lotus! he cried out. *I am afraid. I am afraid of the black sun.*

IV

It was raining again, but no one on Krasna pays attention to that. They wear a few light non-absorbent garments and welcome the rain on their bodies, a moment's relief from saturated hot air. The clouds thin overhead, so that the land glimmers with watery brightness, sometimes even the uppermost clouds break apart and Tau Ceti spears a blinding reddish shaft through smoke-blue masses and silvery rain.

Chang Sverdlov rode into Dynamogorsk with a hornbeast lashed behind his saddle. It had been a dangerous chase, through the tidal marshes and up over the bleak heights of Czar Nicholas IV Range, but he needed evidence to back his story, that he had only been going out to hunt. Mukerji, the chief intelligence officer of the Protectorate garrison, was getting suspicious, God rot his brain.

Two soldiers came along the elevated sidewalk. Rain drummed on their helmets and sluiced off the slung rifles. Earth soldiers went in armed pairs on a street like Trumpet Road: for a Krasnan swamprancher, fisher, miner, logger, trapper, brawling away his accumulated loneliness, with a skinful of vodka or rice wine, a fluff-headed fille-de-joie to impress, and a sullen suspicion that the dice had been loaded, was apt to unlimber his weapons when he saw a blueback.

Sverdlov contented himself with spitting at their boots, which were about level with his head. It went unnoticed in the downpour. And in the noise, and crowding, and blinking lights, with thunder above the city's gables. He clucked to his saurian and guided her toward the middle of the slough called Trumpet Road. Its excitement lifted his anger a bit. *I'll report in,* he told himself, *and go wheedle an advance from the Guild bank, and then make up six weeks of bushranging in a way the joyhouses will remember!*

He turned off on the Avenue of Tigers and stopped before a certain inn. Tethering his lizard and throwing the guard a coin, he entered the taproom. It was as full of men and racket as usual. He shouldered up to the bar. The landlord recognized him; Sverdlov was a very big and solid young man, bullet-headed, crop-haired, with a thick nose and small brown eyes in a pockmarked face. The landlord drew a mug of kvass, spiked it with vodka, and set it out. He nodded toward the ceiling. "I will tell her you are here," he said, and left.

Sverdlov leaned on the bar, one hand resting on a pistol butt, the other holding up his drink. *I could wish it really were one of the upstairs girls expecting me,* he thought. *Do we need all this melodrama of codes, countersigns, and cell organization?* He considered the seething of near-naked men in the room. A chess game, a card game, a dirty joke, an Indian wrestling match, a brag, a wheedle, an incipient fight: his own Krasnans! It hardly seemed possible that any of those ears could have been hired by the Protector and yet . . .

The landlord came back. "She's here and ready for you," he grinned. A couple of nearby men guffawed coarsely. Sverdlov tossed off his drink, lit one of the cheap cigars he favored, and pushed through to the stairs.

At the end of a third-floor corridor he rapped on a door. A voice invited him in. The room beyond was small and drably furnished, but its window looked down a straight street to the town's end and a sudden feathery splendor of rainbow trees. Lightning flimmered through the bright rain of Krasna. Sverdlov wondered scornfully if Earth had jungle and infinite promise on any doorstep.

He closed the door and nodded at the two men who sat waiting. He knew fat Li-Tsung; the gaunt Arabic-looking fellow was strange to him, and neither asked for an introduction.

Li-Tsung raised an eyebrow. Sverdlov said, "It is going well. They were having some new troubles—the aerospores were playing merry hell with the electrical insulation—but I think I worked out a solution. The Wetlanders are keeping our boys amply fed, and there is no indication anyone has betrayed them. Yet."

The thin man asked, "This is the clandestine bomb factory?"

"No," said Li-Tsung. "It is time you learned of these matters, especially when you are leaving the system today. This man has been helping direct something more important than small arms manufacture. They are tooling up out there to make interplanetary missiles."

"What for?" answered the stranger. "Once the Fellowship has seized the mattercaster, it will be years before reinforcements can arrive from any other system. You'll have time enough to build heavy armament then." He glanced inquiringly at Sverdlov. Li-Tsung nodded. "In fact," said the thin man, "my division is trying to so organize things that there will be no closer Protectorate forces than Earth itself. Simultaneous revolution on a dozen planets. Then it would be at least two decades before spaceships could reach Tau Ceti."

"Ah," grunted Sverdlov. He lowered his hairy body into a chair. His cigar jabbed at the thin man. "Have you ever thought, the Earthlings are no fools? The mattercaster for the Tau Ceti System is up there on Moon Two. Sure. We seize it, or destroy it. But is it the *only* transceiver around?"

The thin man choked. Li-Tsung murmured, "This is not for the rank and file. There is enough awe of Earth already, to hold the people back. But in point of fact, the Protector is an idiot if there is not at least one asteroid in some unlikely orbit, with a heavy-duty 'caster mounted on it. We can expect the Navy in our skies within hours of the independence proclamation. We must be prepared to fight!"

"But—" said the thin man. "But this means it will take years more to make ready than I thought. I had hoped—"

"The Centaurians rebelled prematurely, forty years ago," said Li-Tsung. "Let us never forget the lesson. Do you want to be lobotomized?"

There was silence for a while. Rain hammered on the roof. Down in the street, a couple of rangers just in from the Uplands were organizing an impromptu saurian fight.

"Well," said Sverdlov at last. "I'd better not stay here."

"Oh, but you should," said Li-Tsung. "You are supposedly visiting a woman, do you remember?"

Sverdlov snorted impatience, but reached for the little chess set in his pouch. "Who'll play me a quick game, then?"

"Are the bright lights that attractive?" asked Li-Tsung.

Sverdlov spoke an obscenity. "I've spent nearly my whole leave chasing through the bush and up into the Czar," he said. "I'll be off to Thovo—or worse yet, to Krimchak or Cupra or the Belt, Thovo has a settlement at least—for weeks. Months, perhaps! Let me relax a little first."

"As a matter of fact," said Li-Tsung, "your next berth has already been assigned, and it is not to any of those places. It is outsystem." In his public *persona,* he was a minor official in the local branch of the Astronautical Guild.

"What?" Sverdlov cursed for a steady minute. "You mean I'm to be locked up for a month on some stinking ship in the middle of interstellar space, and—"

"Calmly, please, calmly. You won't be standing a routine single-handed just-in-case watch. This will be rather more interesting. You will be on the XA463, the *Southern Cross.*"

Sverdlov considered. He had taken his turn on the stellar vessels, but had no interest in them: they were a chore, one of the less desirable aspects of a spaceman's life. He had even been on duty when a new system was entered, but it had thrilled him not. Its planets turned out to be poisonous hells; he had finished his hitch and gone home before they even completed the transceiver station, the devil could drink his share of the celebration party.

"I don't know which of them that would be," he said.

"It is bound for Alpha Crucis. Or was. Several years ago, the photographs taken by its instruments were routinely robo-analyzed on Earth. There were discrepancies. Chiefly, some of the background stars were displaced, the Einstein effect of mass on light rays. A more careful study revealed there was a feeble source of long radio waves in that direction. They appear to be the dying gasp of a star."

Since Sverdlov's work involved him with the atomic nucleus, he could not help arguing: "I don't think so. The dying gasp, as you put it, would be gravitational potential energy, released as radiation when a star's own fires are all exhausted. But a thing so cold it only emits in the far radio frequencies . . . I'd say that was merely some kind of turbulence in what passes for an atmosphere. That the star isn't just dying, it's *dead.*"

"I don't know," shrugged Li-Tsung. "Perhaps no one does. This expedition will be to answer such questions. They gave up on Alpha Crucis for the time being and decelerated the ship toward this black star. It is arriving there now. The next personnel will take up an orbit and make the initial studies. You are the engineer."

Sverdlov drew heavily on his cigar. "Why me?" he protested. "I'm an interplanetary man. Except for those interstellar tours, I've never even been out of the Tau Ceti System."

"That may be one reason you were picked," said Li-Tsung. "The Guild does not like its men too provincial in outlook."

"Surely," sneered Sverdlov. "We colonials can travel anywhere we please, except to Earth. Only our goods go to Earth without special permission."

"You need not recruit us into the Fellowship of Independence," said the thin man in a parched voice.

Sverdlov clamped teeth together and got out through stiff lips: "There will be Earthlings aboard, won't there? It's asking for trouble, to put me on the same ship as an Earthling."

"You will be very polite and cooperative," said Li-Tsung sharply. "There are other reasons for your assignment. I cannot say much, but you can guess that we have sympathizers, even members, in the Guild . . . on a higher level than spacehand! It is possible that something of potential military value will be learned from the dark star. Who knows? Something about force fields or— Use your own imagination. It can do no harm to have a Fellowship man on the *Cross*. It may do some good. You will report to me when you return."

"Very well, very well," grumbled Sverdlov. "I can stand a month or two of Earthlings, I suppose."

"You will get your official orders soon," Li-Tsung told him. He glanced at his watch. "I think you can run along now; you have a reputation as a, hm-m-m, fast worker. Enjoy yourself."

"And don't get talking drunk," said the thin man.

Sverdlov paused in the doorway. "I don't," he said. "I wouldn't be alive now if I did."

V

The Authority booked first-class passages for all expeditionary personnel, which in the case of a hop up to the Moon meant a direct ferry traveling at one gee all the way. Standing by the observation window, an untasted drink in his hand, David Ryerson remarked: "You know, this is only the third time I've been off Earth. And the other two, we transshipped at Satellite and went free-fall most of the way."

"Sounds like fun," said Maclaren. "I must try it sometime."

"You . . . in your line of work . . . you must go to the Moon quite often," said Ryerson shyly.

Maclaren nodded. "Mount Ambarzumian Observatory, on Farside. Still a little dust and gas to bother us, of course, but I'll let the purists go out to Pluto Satellite and bring me back their plates."

"And— No. Forgive me." Ryerson shook his blond head.

"Go on." Maclaren, seated in a voluptuous formfit lounger, offered a box of cigarettes. He thought he knew Ryerson's type, serious, gifted, ambitious, but awe-smitten at the gimcrack fact of someone's hereditary technic rank. "Go ahead," he invited. "I don't embarrass easy."

"I was only wondering . . . who paid for all your trips . . . the observatory or—"

"Great ancestors! The observatory?" Maclaren threw back his head and laughed with the heartiness of a man who had never had to be very cautious. It rang above the low music and cultivated chatter; even the ecdysiast paused an instant on her stage.

"My dear old colleague," said Maclaren, "I not only pay my own freight, I am expected to contribute generously toward the expenses of the institution. At least," he added, "my father is. But where else would money for pure research come from? You can't tax it out of the lower commons, y' know. They haven't got it. The upper commons are already taxed to the limit, short of pushing them back down into the hand-to-mouth masses. And the Protectorate rests on a technic class serving but not paying. That's the theory, anyhow: in practice, of course, a lot of 'em do neither. But how else would you support abstract science, except by patronage? Thank the Powers for the human snob instinct, it keeps both research and art alive."

Ryerson looked alarmed, glanced about as if expecting momentary arrest, finally lowered himself to the edge of a chair and almost whispered: "Yes, sir, yes, I know, naturally. I was just not so . . . so familiar with the details of . . . financing."

"Eh? But how could you have missed learning? You trained to be a scientist, didn't you?"

Ryerson stared out at Earth, sprawling splendor across the constellations. "I set out to be a spaceman," he said, blushing. "But in the last couple of years I got more interested in gravitics, had to concentrate too much on catching up in that field to . . . well . . . also, I was planning to emigrate, so I wasn't interested in— The colonies need trained men. The opportunities—"

Pioneering is an unlimited chance to become the biggest frog, provided the puddle is small enough, thought Maclaren. But he asked aloud, politely, "Where to?"

"Rama. The third planet of Washington 5584."

"Hm-m-m? Oh, yes. The new one, the GO dwarf. Uh, how far from here?"

"Ninety-seven light-years. Rama has just passed the five-year survey test." Ryerson leaned forward, losing shyness in his enthusiasm. "Actually, sir, Rama is the most nearly terrestroid planet they have yet found. The biochemistry is so similar to Earth's that one can even eat some of the native plants and— Oh, and there are climatic zones, oceans, forests, mountains, a single big moon—"

"And thirty years of isolation," said Maclaren. "Nothing connecting you to the universe but a voice."

Ryerson reddened again. "Does that matter so much?" he asked aggressively. "Are we losing a great deal by that?"

"I suppose not," said Maclaren.

Your lives, perhaps, he thought. *Remember the Shadow Plague on New Kashmir? Or your children—there was the mutation virus on Gondwana. Five years is not long enough to learn a planet; the thirty-year quarantine is an arbitrary minimum. And, of course, there are the more obivous and spectacular things, which merely kill colonists without threatening the human race. Storms, quakes, morasses, volcanoes, meteorites. Cumulative poisoning. Wild animals. Unsuspected half-intelligent aborigines. Strangeness, loneliness, madness. It's no wonder the colonies which survive develop their own cultures. It's no wonder they come to think of Earth as a parasite on their own tedious heroisms. Of course, with ten billion people, and a great*

deal of once arable country sterilized by radiation, Earth has little choice.

What I would like to know is, why does anyone emigrate in the first place? The lessons are ghastly enough; why do otherwise sensible people, like this boy, refuse to learn them?

"Oh, well," he said aloud. He signaled the waiter. "Refuel us, chop-chop."

Ryerson looked in some awe at the chit which the other man thumbprinted. He could not suppress it: "Do you always travel first-class to the Moon?"

Maclaren put a fresh cigarette between his lips and touched his lighter-ring to the end. His smile cocked it at a wry angle. "I suppose," he answered, "I have always traveled first-class through life."

The ferry made turnover without spilling a drink or a passenger and backed down onto Tycho Port. Maclaren adjusted without a thought to Lunar gravity, Ryerson turned a little green and swallowed a pill. But even in his momentary distress, Ryerson was bewildered at merely walking through a tube to a monorail station. Third-class passengers must submit to interminable official bullying: safety regulations, queues, assignment to hostel. Now, within minutes, he was again on soft cushions, staring through crystalline panes at the saw-toothed magnificence of mountains.

When the train got under way, he

gripped his hands together, irrationally afraid. It took him a while to hunt down the reason: the ghost of his father's God, ranting at pride and sloth from the tomb which the son had erected.

"Let's eat," said Maclaren. "I chose this train with malice aforethought. It's slow enough so we can enjoy our meal en route, and the chef puts his heart into the oysters won-ton."

"I'm not . . . not hungry," stammered Ryerson.

Maclaren's dark, hooked face flashed a grin. "That's what cocktails and hors d'oeuvres are for, lad. Stuff yourself. If it's true what I've heard of deep-space rations, we're in for a dreary month or two."

"You mean you've never been on an interstellar ship?"

"Of course not. Never been beyond the Moon in my life. Why should I do any such ridiculous thing?"

Maclaren's cloak swirled like fire as he led the way toward the diner. Beneath an iridescent white tunic, his legs showed muscular and hairless, down to the tooled-leather buskins; the slant of the beret on his head was pure insolence. Ryerson, trailing drably behind in spaceman's gray coveralls, felt bitterness. *What have I been dragged away from Tamara for? Does this peacock know a mass from a hole in the ground? He's hired himslef a toy, is all, because for a while he's bored with wine and women . . . and Tamara is locked away on a rock with a self-righteous old beast who hates the sound of her name!*

As they sat down at their table, Maclaren went on, "But this is too good a chance to pass up. I found me a tame mathematician last year and sicced him onto the Schrödinger equation—Sugimoto's relativistic version, I mean; Yuen postulates too bloody much for my taste—anyhow, he worked it out for the quantities involved in a dark star, mass and gravitational intensities and cetera. His results make us both wonder if such a body doesn't go over to an entirely new stage of degeneracy at the core. One gigantic neutron? Well, maybe that's too fantastic. But consider—"

And while the monorail ran on toward Farside, Maclaren left the Interhuman language quite behind him. Ryerson could follow tensors, even when scribbled on a menu, but Maclaren had some new function, symbolized by a pneumatic female outline, that *reduced* to a generalized tensor under certain conditions. Ryerson stepped out on Farside, two hours later, with his brain rotating.

He had heard of the cyclopean installations which fill the whole of Yukawa Crater and spread out onto the plains beyond. Who has not? But all he saw on his first visit was a gigantic concourse, a long slideway tunnel, and a good many uniformed technicians. He made some timid mention of his disappointment to Maclaren. The New Zealander nodded: "Exactly. There's more romance, more sense of distance covered, and a devil of a lot better scenery, in an afternoon on the bay, than in a fifty light-year leap. I say space travel is overrated. And it's a fact, I've heard, that spacemen themselves prefer the interplanetary runs. They take the dull interstellar watches as a matter of duty, by turns."

Here and there the tunnel branched off, signs indicating the way to Alpha Centauri Jump, Tau Ceti Jump, Epsilon Eridani Jump, all the long-colonized systems. Those were for passengers; freight went by other beams. There was no great bustle along any of the tubes. Comparatively few Earthlings had occasion to visit outsystem on business, still fewer could afford it for pleasure, and of course no colonial came here without a grudging O.K. The Protector had trouble enough; he was not going to expose the mother planet and its restless billions to new ideas born under new skies, nor let any more colonials than he could help see first-hand what an inferior position they held. That was the real reason for the ban, every educated Terrestrial knew as much. The masses, being illiterate, swallowed a vague official excuse about trade policy.

The branches leading to Sirius Jump, Procyon Jump, and the other attained but uncolonizable systems, were almost deserted. Little came from such places—perhaps an occasional gem or exotic chemical. But relay stations had been established there, for 'casting to more useful planets.

Ryerson's heart leaped when he passed a newly activated sign: an arrow and WASHINGTON 5584 JUMP burning above. *That* tunnel would be filled, come next week!

He should have been in the line. And Tamara. Well, there would be later waves. His passage was already paid for, he had had no difficulty about transferring to another section.

To make conversation, he said through a tightness: "Where are the bulkheads?"

"Which ones?" asked Maclaren absently.

"Safety bulkheads. A receiver does fail once in a great while, you know. That's why the installations here are spread out so much, why every star has a separate 'caster. There's a vast amount of energy involved in each transmission—one reason why a 'casting is more expensive than transportation by spaceship. Even a small increment, undissipated, can melt a whole chamber."

"Oh, yes. That." Maclaren had let Ryerson get pompous about the obvious because it was plain he needed something to bolster himself. What itched the kid, anyhow? One should think that when the Authority offered a fledgling a post on an expedition as fundamental as this— Of course, it had upset Ryerson's plans of emigration. But not importantly. There was no danger he would find all the choice sites on Rama occupied if he came several weeks late: too few people had the fare as it was.

Maclaren said, "I see what you

mean. Yes, the bulkheads are there, but recessed into the walls and camouflaged. You don't want to emphasize possible danger to the cash customers, eh? Some technic might get annoyed and make trouble."

"Some day," said Ryerson, "they'll reduce the energy margin needed; and they'll figure how to reproduce a Frank tube, rather than manufacture it. Record the pattern and recreate from a matter bank. Then anyone can afford to ride the beams. Interplanetary ships, even air and surface craft, will become obsolete."

Maclaren made no answer. He had sometimes thought, more or less idly, about the unrealized potentialities of mattercasting. Hard to say whether personal immortality would be a good thing or not. Not for the masses, surely! Too many of them as it was. But a select few, like Terangi Maclaren—or was it worth the trouble? Even given boats, chess, music, the No Drama, beautiful women and beautiful spectroscopes, life could get heavy.

As for matter transmission, the difficulty and hence the expense lay in the complexity of the signal. Consider an adult human. There are some 10^{14} cells in him, each an elaborate structure involving many proteins with molecular weights in the millions. You had to scan every one of those molecules—identify it structurally, ticket its momentary energy levels, and place it in proper spatiotemporal relationship to every other molecule—as nearly simultaneously as the laws of physics permitted. You couldn't take a man apart, or reassemble him, in more than a few microseconds; he wouldn't survive it. You couldn't even transmit a recognizable beefsteak in much less of a hurry.

So the scanning beam went through and through, like a blade of energy. It touched every atom in its path, was modified thereby, and flashed that modification onto the transmitter matrix. But such fury destroyed. The scanned object was reduced to gas, so quickly that only an oscilloscope could watch the process. The gas was sucked into the destructor chamber and atomically condensed in the matter bank; in time it would become an incoming passenger, or incoming freight. In a sense, the man had died.

If you could record the signal which entered the transmitter matrix —you could keep such a record indefinitely, recreate the man and his instantaneous memories, thoughts, habits, prejudices, hopes and loves and hates and horrors, a thousand years afterward. You could create a billion identical men. Or, more practically, a single handmade prototype could become a billion indistinguishable copies; nothing would be worth more than any handful of dirt. Or . . . superimpose the neurone trace-patterns, memories, of a lifetime, onto a recorded twenty-year-old body, be born again and live forever!

The signal was too complex, though. An unpromising research program went on. Perhaps in a few centuries they would find some trick which would enable them to record a man, or even a Frank tube. Meanwhile, transmission had to be simultaneous with scanning. The signal went out. Probably it would be relayed a few times. Eventually the desired receiving chamber got it. The receiver matrix, powered by dying atomic nuclei, flung gases together, formed higher elements, formed molecules and cells and dreams according to the signal, in microseconds. It was designed as an energy-consuming process, for obvious reasons: packing fraction energy was dissipated in gravitic and magnetic fields, to help shape the man. (Or the beefsteak, or the spaceship, or the colonial planet's produce.) He left the receiving chamber and went about his business.

A mono-isotopic element is a simple enough signal to record, Maclaren reminded himself, *though even that requires a houseful of transistor elements. So this civilization can afford to be extravagant with metals—can use pure mercury as the raw material of a spaceship's blast, for instance. But we still eat our bread in the sweat of some commoner's brow.*

Not for the first time, but with no great indignation—life was too short for anything but amusement at the human race—Maclaren wondered if the recording problem really was as difficult as the physicists claimed. No government likes revolutions, and molecular duplication would revolutionize society beyond imagining. Just think how they had to guard the stations as it was, and stick them out here on the Moon . . . otherwise, even today, some fanatic could steal a tube of radium from a hospital and duplicate enough to sterilize a planet!

"Oh, well," he said, half aloud.

They reached the special exploratory section and entered an office. There was red tape to unsnarl. Ryerson let Maclaren handle it, and spent the time trying to understand that soon the pattern which was himself would be embodied in newly-shaped atoms, a hundred light-years from Tamara. It wouldn't penetrate. It was only words.

Finally the papers were stamped. The transceivers to/from an interstellar spaceship could handle several hundred kilos at a time; Maclaren and Ryerson went together. They had a moment's wait because of locked safety switches on the *Southern Cross*: someone else was arriving or departing ahead of them.

"Watch that first step," said Maclaren. "It's a honey."

"What?" Ryerson blinked at him, uncomprehending.

The circuit closed. There was no sensation, the process went too fast.

The scanner put its signal into the matrix. The matrix modulated the carrier wave. But such terminology is mere slang, borrowed from electronics. You cannot have a "wave" when you have no velocity, and gravitational forces do not. (This is a more accurate rendition of the common statement that "gravitation propagates at an infinite speed.") Inconceivable energies surged within a thermonuclear fire chamber; nothing controlled them, nothing could control them, but the force fields they themselves generated. Matter pulsed in and out of existence *qua* matter, from particle to gamma ray quantum and back. Since quanta have no rest mass, the pulsations disturbed the geometry of space according to the laws of Einsteinian mechanics. Not much: gravitation is feebler than magnetism or electricity. Were it not for the resonance effect, the signal would have been smothered in "noise" a few kilometers away. Even as it was, there were many relayings across the parsecs, until the matrix on the *Cross* reacted. And yet in one sense no time at all had passed; and no self-respecting mathematician would have called the "beam" by such a name. It was, however, a signal, the only signal which relativity physics allowed to go faster than light—and, after all, it did not really *go,* it simply *was.*

Despite the pill inside him, Ryerson felt as if the bottom had dropped out of the world. He grabbed for a handhold. The after-image of the transmitter chamber yielded to the coils and banks of the receiver room on a spaceship. He hung weightless, a thousand billion billion kilometers from Earth.

VI

Forward of the 'casting chambers, "above" them during acceleration, were fuel deck, gyros, and air renewal plant. Then you passed through the observation deck, where instruments and laboratory equipment crowded together. A flimsy wall around the shaftway marked off the living quarters: folding bunks, galley, bath, table, benches, shelves, and lockers, all crammed into a six-meter circle.

Seiichi Nakamura wrapped one leg casually around a stanchion, to keep himself from drifting in air currents, and made a ceremony out of leafing through the log-book in his hands. It gave the others a chance to calm down, and the yellow-haired boy, David Ryerson, seemed to need it. The astrophysicist, Maclaren, achieved the unusual feat of lounging in free fall; he puffed an expensive Earth-side cigarette and wrinkled his patrician nose at the pervading smell of an old ship, two hundred years of cooking and sweat and machine oil. The big, ugly young engineer, Sverdlov, merely looked sullen. Nakamura had never met any of them before.

"Well, gentlemen," he said at last. "Pardon me, I had to check the data recorded by the last pilot. Now I know approximately where we are at." He laughed with polite self-deprecation. "Of course you are all familiar with the articles. The pilot is captain. His duty is to guide the ship where the chief scientist—Dr. Maclaren-san in this case—wishes, within the limits of safety as determined by his own judgment. In case of my death or disability, command devolves upon the engineer, ah, Sverdlov-san, and you are to return home as soon as practicable. Yes-s-s. But I am sure we will all have a most pleasant and instructive expedition together."

He felt the banality of his words. It was the law, and a wise one, that authority be defined at once if there were non-Guild personnel aboard. Some pilots contented themselves with reading the regulations aloud, but it had always seemed an unnecessarily cold procedure to Nakamura. Only . . . he saw a sick bewilderment in Ryerson's eyes, supercilious humor in Maclaren's, angry impatience in Sverdlov's . . . his attempt at friendliness had gone flat.

"We do not operate so formally," he went on in a lame fashion. "We shall post a schedule of housekeeping duties and help each other, yes? Well. That is for later. Now as to the star, we have some approximate data and estimates taken by previous watches. It appears to have about four times the mass of Sol; its radius is hardly more than twice Earth's, possibly less; it emits detectably only in the lower radio frequencies, and even that is feeble. I have here a quick reading of the spectrum which may interest you, Dr. Maclaren."

The big dark man reached out for it. His brows went up. "Now this," he said, "is the weirdest collection of wave lengths I ever saw." He flickered experienced eyes along the column of numbers. "Seems to be a lot of triplets, but the lines appear so broad, judging from the probable errors given, that I can't be sure without more careful . . . hm-m-m." Glancing back at Nakamura: "Just where are we with relation to the star?"

"Approximately two million kilometers from the center of its mass. We are being drawn toward it, of course, since an orbit has not yet been established, but have enough radial velocity of our own to—"

"Never mind." The sophistication dropped from Maclaren like a tunic. He said with a boy's eagerness, "I would like to get as near the star as possible. How close do you think you can put us?"

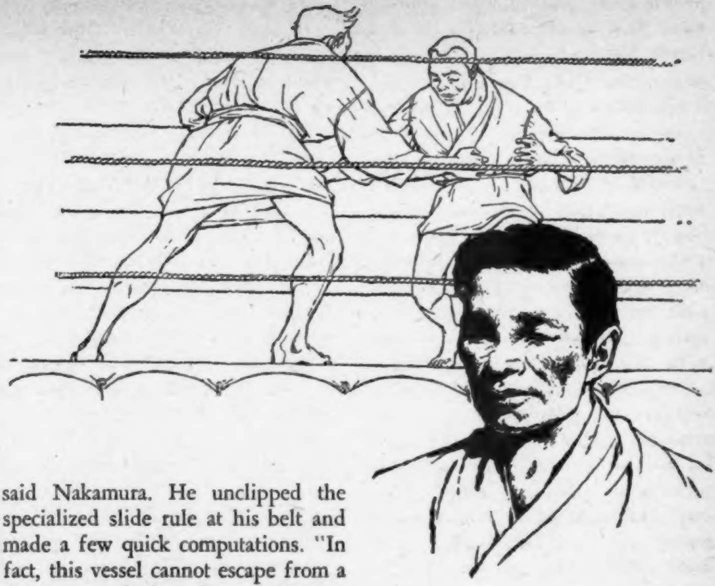
Nakamura smiled. He had a feeling Maclaren could prove likable. "Too close isn't prudent. There would be meteors."

"Not around this one!" exclaimed Maclaren. "If physical theory is anything but mescaline dreams, a dead star is the clinker of a supernova. Any matter orbiting in its neighborhood became incandescent gas long ago."

"Atmosphere?" asked Nakamura dubiously. "Since we have nothing to see by, except starlight, we could hit its air."

"Hm-m-m. Yes. I suppose it would have some. But not very deep: too compressed to be deep. In fact, the radio photosphere, from which the previous watches estimated the star's diameter, must be nearly identical with the fringes of atmosphere."

"It would also take a great deal of reaction mass to pull us back out of its attraction, if we got too close,"



said Nakamura. He unclipped the specialized slide rule at his belt and made a few quick computations. "In fact, this vessel cannot escape from a distance much less than three-quarters million kilometers, if there is to be reasonable amount of mass left for maneuvering around afterward. And I am sure you wish to explore regions farther from the star, yes-s-s? However, I am willing to go that close."

Maclaren smiled. "Good enough. How long to arrive?"

"I estimate three hours, including time to establish the orbit." Nakamura looked around their faces. "If everyone is prepared to go on duty, it is best we get into the desired path at once."

"Not even a cup of tea first?" grumbled Sverdlov.

Nakamura nodded at Maclaren and Ryerson. "You gentlemen will please prepare tea and sandwiches, and take them to the engineer and myself in about ninety minutes."

"Now, wait!" protested Maclaren. "We've hardly arrived. I haven't even looked at my instruments. I have to set up—"

"In ninety minutes, if you will be so kind. Very well, let us assume our posts."

Nakamura turned from Maclaren's suddenly mutinous look and Sverdlov's broad grin. He entered the shaftway and pulled himself along it by the rungs. Through the transparent plastic he saw the observation deck fall behind. The boat deck was next, heavy storage levels followed, and then he was forward, into the main turret.

It was a clear plastic bubble, unshuttered now when the sole outside illumination was a wintry blaze of stars. Floating toward the controls, Nakamura grew aware of the silence. So quiet. So uncountably many stars. The constellations were noticeably distorted, some altogether foreign. He searched a crystal darkness for Capella, but the bulge of the ship hid it from him. No use looking for Sol without a telescope, here on the lonely edge of the known.

Fear of raw emptiness lay tightly coiled within him. He smothered it by routine: strapped himself before the console, checked the instruments one by one, spoke with Sverdlov down the length of the ship. His fingers chattered out a computation on a set of keys, he fed the tape to the robot, he felt a faint tug as the gyros woke up, swiveling the vessel into position for blast. Even now, at the end of acceleration to half light-speed and deceleration to a few hundred kilometers per second, the *Cross* bore several tons of reaction-mass mercury. The total mass, including hull, equipment, and payload, was a bit over one kiloton. Accordingly, her massive gyroscopes needed half an hour to turn her completely around.

Waiting, he studied the viewscreens. Since he must back down on his goal, what they showed him was more important than what his eyes saw through this turret in the nose. He could not make out the black sun. *Well, what do you expect?* he asked himself angrily. *It must be occulting a few stars, but there are too many.* "Dr. Maclaren," he said into the intercom, "can you give me a radio directional on the target, as a check?"

"Aye, aye." A surly answer. Maclaren resented having to put his toys to work. He would rather have been taking spectra, reading ionoscopes, gulping gas and dust samples from outside into his analyzers, every centimeter of the way. Well, he would just have to get those data when they receded from the star again.

Nakamura's eyes strayed down the ship herself, as shown in the viewscreens. *Old,* he thought. *The very nation which built her has ceased to exist. But good work. A man's work outlives his hands. Though what remains of the little ivory figures my father carved to ornament our house? What chance did my brother have to create, before he shriveled in my arms? No!* He shut off the thought, like a surgeon clamping a vein, and refreshed his memory of the *Cygnus* class.

This hull was a sphere of reinforced self-sealing plastic, fifty meters across, its outside smoothness broken by hatches, ports, air locks, and the like. The various decks sliced it in parallel planes. Aft, diametrically opposite this turret, the hull opened on the fire chamber. And thence ran two thin metal skeletons, thirty meters apart, a hundred meters long, like radio masts or ancient oil derricks. They comprised two series of rings, a couple of centimeters in diameter, with auxiliary wiring and a spidery framework holding it all together—the ion accelerators, built into and supported by the gravitic transceiver web.

"A ten-second test blast, if you please, Engineer Sverdlov," said Nakamura.

The instruments showed him a certain unbalance in the distribution of mass within the hull. Yussuf bin Suleiman, who had just finished watch aboard the ship and gone back to Earth, was sloppy about . . . no, it was unjust to think so . . . say that he had his own style of piloting. Nakamura set the pumps to work. Mercury ran from the fuel deck to the trim tanks.

By then the ship was pointed correctly and it was time to start decelerating again. "Stand by for blast . . . Report . . . I shall want one-point-five-seven standard gees for—" Nakamura reeled it off almost automatically.

It rumbled in the ship. Weight came, like a sudden fist in the belly. Nakamura held his body relaxed in harness, only his eyes moved, now and then a finger touched a control. The secret of judo, of life, was to hold every part of the organism at ease except those precise tissues needed for the moment's task— Why was it so damnably difficult to put into practice?

Mercury fed through pipes and pumps, past Sverdlov's control board, past the radiation wall, into the expansion chamber and through the ionizer and so as a spray past the sunlike heart of a thermonuclear plasma. Briefly, each atom endured a rage of mesons. It broke down, gave up its mass as pure energy, which at once became proton-antiproton pairs. Magnetic fields separated them as they were born: positive and negative particles fled down the linear accelerators. The plasma, converting the death of matter directly to electricity, charged each ring at a successively higher potential. When the particles emerged from the last ring, they were traveling at three-fourths the speed of light.

At such an exhaust velocity, no great mass had to be discharged. Nor was the twin stream visible; it was too efficient. Sensitive instruments might have detected a pale gamma-colored splotch, very far behind the ship, as a few opposite charges finally converged on each other, but that effect was of no importance.

The process was energy-eating. It had to be. Otherwise surplus heat would have vaporized the ship. The plasma furnished energy to spare. The process was a good deal more complex than a few words can describe, and yet less so than an engineer accustomed to more primitive branches of his art might imagine.

Nakamura gave himself up to the instruments. Their readings checked out with his running computation. The *Cross* was approaching the black star in a complex spiral curve, the resultant of several velocities and two accelerating vectors, which would become a nearly circular orbit seven hundred fifty thousand kilometers out.

He started to awareness of time when young Ryerson came up the shaftway rungs. "Oh," he exclaimed.

"Tea, sir," said the boy shyly.

"Thank you. Ah . . . set it down there, please . . . the regulations forbid entering this turret during blast without inquiring of the— No, no. Please!" Nakamura waved a hand, laughing. "You did not know. There is no harm done."

He saw Ryerson, stooped under one and a half gravities, lift a heavy head to the foreign stars. The Milky Way formed a cold halo about his tangled hair. Nakamura asked gently, "This is your first time in extrasolar space, yes?"

"Y-yes, sir." Ryerson licked his lips. The blue eyes were somehow hazy, unable to focus closer than the nebulae.

"Do not—" Nakamura paused. He had been about to say, "Do not be afraid," but it might hurt. He felt after words. "Space is a good place to meditate," he said. "I use the wrong word, of course. 'Meditation,' in Zen, consists more of an attempt at identification with the universe than verbalized thinking. What I mean to say," he floundered, "is this: Some people feel themselves so helplessly small out here that they become frightened. Others, remembering that home is no more than a step away through the transmitter, become careless and arrogant, the cosmos merely a set of meaningless numbers to them. Both attitudes are wrong, and have killed men. But if you think of yourself as being a *part* of everything else — integral — the same forces in you which shaped the suns . . . do you see?"

"The heavens declare the glory of God," whispered Ryerson, "and the firmament showeth His handiwork . . . It is a terrible thing to fall into the hands of the living God."

He had not been listening, and Nakamura did not understand English. The pilot sighed. "I think you had best return to the observation deck," he said. "Dr. Maclaren may have need of you."

Ryerson nodded mutely and went back down the shaft.

I preach a good theory, Nakamura told himself. *Why can I not practice it? Because a stone fell from heaven onto Sarai, and suddenly father and mother and sister and house were not. Because Hideki died in my arms, after the universe had casually tortured him. Because I shall never see Kyoto again, where every morning was full of cool bells. Because I am a slave of myself.*

And yet, he thought, *sometimes I have achieved peace. And only in space.*

Now he saw the dead sun through a viewscreen, when his ship swung so that it transitted the Milky Way. It was a tiny blackness. The next time around, it had grown. He wondered if it was indeed blacker than the sky. Nonsense. It should reflect starlight, should it not? But what color was metallic hydrogen? What gases overlay the metal? Space, especially here, was not absolutely black: there was a certain thin but measurable nebular cloud around the star. So conceivably the star might be blacker than the sky.

"I must ask Maclaren," he murmured to himself. "He can measure it, very simply, and tell me. Meditation upon the concept of blacker than total blackness is not helpful, it seems." That brought him a wry humor, which untensed his muscles. He grew aware of weariness. It should not have been; he had only been sitting here and pressing controls. He poured a cup of scalding tea and drank noisily and gratefully.

Down and down. Nakamura fell into an almost detached state. Now the star was close, not much smaller than the Moon seen from Earth. It grew rapidly, and crawled still more rapidly around the circle of the viewscreens. Now it was as big as Batu, at closest approach to Sarai. Now it was bigger. The rhythms entered Nakamura's blood. Dimly, he felt himself become one with the ship, the fields, the immense interplay of forces. And this was why he went again and yet again into space. He touched the manual controls, assisting the robots, correcting, revising, in a pattern of unformulated but bodily known harmonies, a dance, a dream, yielding, controlling, unselfness, Nirvaan, peace and wholeness . . .

Fire!

The shock rammed Nakamura's spine against his skull. He felt his teeth clashed together. Blood from a bitten tongue welled in his mouth. Thunder roared between the walls.

He stared into the screens, clawing for comprehension. The ship was a million or so kilometers out. The black star was not quite one degree wide, snipped out of an unnamed alien constellation. The far end of the ion accelerator system was white hot. Even as Nakamura watched, the framework curled up, writhed like fingers in agony, and vaporized.

"What's going on?" Horror bawled from the engine room.

The thrust fell off and weight dropped sickeningly. Nakamura saw hell eat along the accelerators. He jerked his eyes around to the primary megammeter. Its needle sank down a tale of numbers. The four outermost rings were already destroyed. Even as he watched, the next one shriveled.

It could not be felt, but he knew how the star's vast hand clamped on the ship and reeled her inward.

Metal whiffed into space. Underloaded, the nuclear system howled its anger. Echoes banged between shivering decks.

"Cut!" cried Nakamura. His hand slapped the pilot's master switch.

The silence that fell, and the noweight, were like death.

Someone's voice gabbled from the observation deck. Automatically, Nakamura chopped that interference out of the intercom circuit. "Engineer

Sverdlov," he called. "What happened? Do you know what is wrong?"

"No. No." A groan. But at least the man lived. "Somehow the . . . the ion streams . . . seem to have . . . gotten diverted. The focusing fields went awry. The blast struck the rings—but it couldn't happen!"

Nakamura hung onto his harness with all ten fingers. *I will not scream,* he shouted. *I will not scream.*

"The 'caster web seems to be gone, too," said a rusty machine using his throat. His brother's dead face swam among the stars, just outside the turret, and mouthed at him.

"Aye." Sverdlov must be hunched over his own viewscreens. After a while that tingled, he said harshly: "Not yet beyond repair. All ships carry a few replacement parts, in case of meteors or— We can repair the web and transmit ourselves out of here."

"How long to do that job? Quickly!"

"How should I know?" A dragon snarl. Then: "I'd have to go out and take a closer look. The damaged sections will have to be cut away. It'll probably be necessary to machine some fittings. With luck, we can do it in several hours."

Nakamura paused. He worked his hands together, strength opposing strength; he drew slow breaths, rolled his head to loosen the neck muscles, finally closed his eyes and contemplated peace for as long as needful. And a measure of peace came. The death of this little ego was not so terrible after all, provided said ego refrained from wishing to hold Baby-san in its arms just one more time.

Almost absently, he punched the keys of the general computer. It was no surprise to see his guess verified.

"Are you there?" called Sverdlov, as if across centuries. "Are you there, pilot?"

"Yes. I beg your pardon. Several hours to repair the web, did you say? By that time, drifting free, we will have crashed on the star."

"What? But—"

"Consider its acceleration of us. And we still have inward radial velocity of our own. I think I can put us into an orbit before the whatever-it-is force has quite destroyed the accelerators. Yes."

"But you'll burn them up! And the web! We'll damage the web beyond repair!"

"Perhaps something can be improvised, once we are in orbit. But if we continue simply falling, we are dead men."

"No!" Almost, Sverdlov shrieked. "Listen, maybe we can repair the web in time. Maybe we'll only need a couple of hours for the job. There's a chance. But caught in an orbit, with the web melted or vaporized . . . do you know how to build one from raw metal? I don't!"

"We have a gravitics specialist aboard. If anyone can fashion us a new transmitter, he can."

"And if he can't, we're trapped out here! To starve! Better to crash and be done!"

Nakamura's hands began to dance over the keyboard. He demanded data of the instruments, calculations of the computers, and nothing of the autopilot. For no machine could help steer a vessel whose thrust-engine was being unpredictably devoured. This would be a manual task.

"I am the captain," he said, as mildly as possible.

"Not any more!"

Nakamura slapped his master switch. "You have just been cut out of the control circuits," he said. "Please remain at your post." He opened the intercom to the observation deck. "Will the two honorable scientists be so kind as to stop the engineer from interfering with the pilot?"

VII

For a moment, the rage in Chang Sverdlov was such that blackness flapped before his eyes.

When he regained himself, he found the viewscreens still painted with ruin. Starlight lay wan along the frail network of the transceiver web and the two sets of rings which it held together. At the far end the metal glowed red. A few globs of spattered stuff orbited like lunatic fireflies. Beyond the twisted burnt-off end of the system, light-years dropped away to the cold blue glitter of a thousand crowding stars. The dead sun was just discernible, a flattened darkness. It seemed to be swelling visibly. Whether that was a real effect or not, Sverdlov felt the dread of falling, the no-weight horrors, like a lump in his belly.

He hadn't been afraid of null-gee since he was a child. In his cadet days, he had invented more pranks involving free fall than any two other boys. But he had never been cut off from home in this fashion. Krasna had never been more than an interplanetary flight or an interstellar Jump away.

And that cookbook pilot would starve out here to save his worthless ship?

Sverdlov unbuckled his harness. He kicked himself across the little control room, twisted among the pipes and wheels and dials of the fuel-feed section like a swimming fish, and came to the tool rack. He chose a long wrench and arrowed for the shaftway. His fury had chilled into resolution: *I don't want to kill him, but he'll have to be made to see reason. And quickly, or we really will crash!*

He was rounding the transmitter chamber when deceleration resumed. He had been going up by the usual process, grab a rung ahead of you and whip your weightless body beyond. Suddenly two Terrestrial gravities snatched him.

He closed fingers about one of the bars. His left arm straightened, with a hundred and ninety kilos behind. The hand tore loose. He let go the wrench and caught with his right arm, jamming it between a rung and the shaft wall. The impact smashed across his biceps. Then his left hand clawed fast and he hung. He heard

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VII

For a moment, the rage in Chang Sverdlov was such that blackness flapped before his eyes.

When he regained himself, he found the viewscreens still painted with ruin. Starlight lay wan along the frail network of the transceiver web and the two sets of rings which it held together. At the far end the metal glowed red. A few globs of spattered stuff orbited like lunatic fireflies. Beyond the twisted burnt-off end of the system, light-years dropped away to the cold blue glitter of a thousand crowding stars. The dead sun was just discernible, a flattened darkness. It seemed to be swelling visibly. Whether that was a real effect or not, Sverdlov felt the dread of falling, the no-weight horrors, like a lump in his belly.

He hadn't been afraid of null-gee since he was a child. In his cadet days, he had invented more pranks involving free fall than any two other boys. But he had never been cut off from home in this fashion. Krasna had never been more than an interplanetary flight or an interstellar Jump away.

And that cookbook pilot would starve out here to save his worthless ship?

Sverdlov unbuckled his harness. He kicked himself across the little control room, twisted among the pipes and wheels and dials of the fuel-feed section like a swimming fish, and came to the tool rack. He chose a long wrench and arrowed for the shaftway. His fury had chilled into resolution: *I don't want to kill him, but he'll have to be made to see reason. And quickly, or we really will crash!*

He was rounding the transmitter chamber when deceleration resumed. He had been going up by the usual process, grab a rung ahead of you and whip your weightless body beyond. Suddenly two Terrestrial gravities snatched him.

He closed fingers about one of the bars. His left arm straightened, with a hundred and ninety kilos behind. The hand tore loose. He let go the wrench and caught with his right arm, jamming it between a rung and the shaft wall. The impact smashed across his biceps. Then his left hand clawed fast and he hung. He heard the wrench skid past the gyro housing, hit a straight dropoff, and clang on the after radiation shield.

Gasping, he found a lower rung with his feet and sagged for a minute. The right arm was numb, until the pain woke in it. He flexed the fingers. Nothing broken.

But he was supposed to be in harness. Nakamura's calculations might demand spurts of ten or fifteen gravities, if the accelerators could still put out that much. The fear of being smeared across a bulkhead jolted into Sverdlov. He scrambled over the rungs. It was nightmarishly like climbing through glue. After a thousand years he burst into the living quarters.

Maclaren sat up in one of the bunks. "No further, please," he said.

The deceleration climbed a notch. His weight was iron on Sverdlov's shoulders. He started back into the shaft. "No!" cried Ryerson. But it was Maclaren who flung off bunk harness and climbed to the deck. The brown face gleamed wet, but Maclaren smiled and said: "Didn't you hear me?"

Sverdlov grunted and re-entered the shaft, both feet on a rung. *I can make it up to the bubble and get my hands on Nakamura's throat.* Maclaren stood for a gauging instant, as Sverdlov's foot crept toward the next rung. Finally the physicist added with a sneer in the tone: "When a technic says sit, you squat . . . colonial."

Sverdlov halted. "What was that?" he asked slowly.

"I can haul you out of there if I must, you backwoods pig," said Maclaren, "but I'd rather you came to me."

Sverdlov wondered, with an odd quick sadness, why he responded. Did an Earthlings's yap make so much difference? He decided that Maclaren would probably make good on that promise to follow him up the shaft, and under this weight a fight on the rungs could kill them both. Therefore—Sverdlov's brain seemed as heavy as his bones. He climbed back and stood slumping on the observation deck. "Well?" he said.

Maclaren folded his arms. "Better get into a bunk," he advised.

Sverdlov lumbered toward him. In a shimmery wisp of tunic, the Earthling looked muscular enough, but he probably massed ten kilos less, and lacked several centimeters of the Krasnan's height and reach. A few swift blows would disable him, and it might still not be too late to stop Nakamura.

"Put up your fists," said Sverdlov hoarsely.

Maclaren unfolded his arms. A sleepy smile crossed his face. Sverdlov came in, swinging at the eagle beak. Maclaren's head moved aside. His hands came up, took Sverdlov's arm, and applied a cruel leverage. Sverdlov gasped, broke free by sheer strength, and threw a blow to the ribs. Maclaren stopped that fist with an edge-on chop at the wrist behind it; almost, Sverdlov thought he felt the bones crack. They stood toe to toe. Sverdlov drew back the other fist. Maclaren punched him in the groin. The Krasnan doubled over in a jag of anguish. Maclaren rabbit-punched him. Sverdlov went to one knee. Maclaren kicked him in the solar plexus. Sverdlov fell over and struck the floor with three gravities to help.

Through a wobbling, ringing darkness, he heard the Earthling: "Help me with this beef, Dave." And he felt himself dragged across the floor, somehow manhandled into a bunk and harnessed.

His mind returned. Pain stabbed and flickered through him. He struggled to sit up. "That was an Earthman way to fight," he pushed out through a swelling mouth.

"I don't enjoy fighting," said Maclaren from his own bunk, "so I got it over with as soon as possible."

"You—" The Krasnan lifted grotesquely heavy hands and fumbled with his harness. "I'm going to the control turret. If you try to stop me this time—"

"You're already too late, brother Sverdlov," said Maclaren coolly. "Whatever you were setting out to forestall has gone irrevocably far toward happening."

The words were a physical blow.

"It's . . . yes," said the engineer. "I'm too late." The shout burst from him: "We're all too late, now!"

"Ease back," said Maclaren. "Frankly, your behavior doesn't give me much confidence in your judgment about anything."

It rumbled through the ship. That shouldn't be, thought Sverdlov's training; even full blast ought to be nearly noiseless, and this was only fractional. Sweat prickled his skin. For the first time in a violent life, he totally realized that he could die.

"I'm sorry for what I called you," said Maclaren. "I had to stop you, but now I apologize."

Sverdlov made no answer. He stared up at a blank ceiling. Oddly, his first emotion, as rage ebbed, was an overwhelming sorrow. Now he would never see Krasna made free.

VIII

Silence and no-weight were dreamlike. For a reason obscure to himself, Maclaren had dimmed the fluoros around the observation deck, so that twilight filled it and the scientific apparatus crouched in racks and on benches seemed to be a herd of long-necked monsters. Thus there was nothing to drown the steely brilliance of the stars, when you looked out an unshuttered port.

The star hurtled across his field of view. Her eccentric orbit took the *Cross* around it in thirty-seven minutes. Here, at closest approach, they were only half a million kilometers away. The thing had the visual diameter of three full Moons. It was curiously vague of outline: a central absolute blackness, fading toward deep gray near the edges where starlight caught an atmosphere more savagely compressed than Earth's ocean abyss. Through the telescope, there seemed to be changeable streaks and mottlings, bands, spots, a hint of color too faint for the eye to tell . . . as if the ghosts of burned-out fires still walked.

Quite oblate, Maclaren reminded himself. *That would have given us a hint, if we'd known. Or the radio spectrum; now I realize, when it's too late, that the lines really* are *triplets, and their broadening is Doppler shift.*

The silence was smothering.

Nakamura drifted in. He poised himself in the air and waited quietly.

"Well?" said Maclaren.

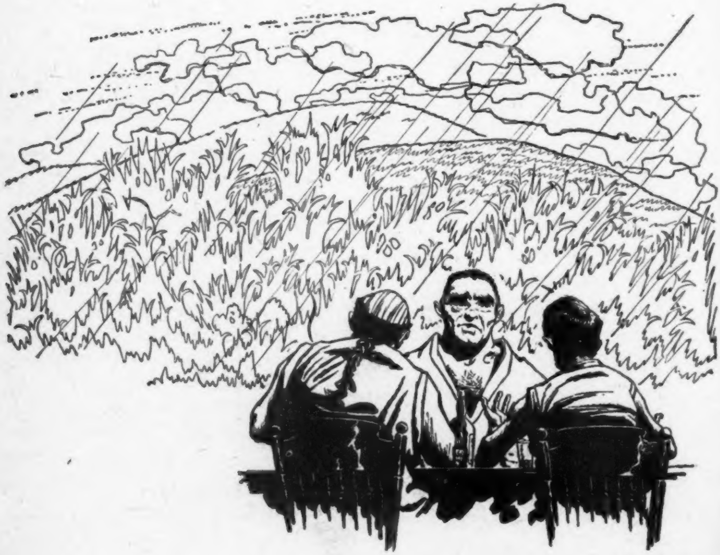
"Sverdlov is still outside, looking at the accelerators and web," said Nakamura. "He will not admit there is no hope."

"Neither will I," said Maclaren.

"Virtually the whole system is destroyed. Fifty meters of it have vanished. The rest is fused, twisted, short-circuited . . . a miracle it continued to give some feeble kind of blast, so I could at least find an orbit." Nakamura laughed. Maclaren thought that that high-pitched, apologetic giggle was going to be hard to live with, if one hadn't been raised among such symbols. "We carry a few spare parts, but not that many."

"Perhaps we can make some," said Maclaren.

"Perhaps," said Nakamura. "But



of course the accelerators are of no importance in themselves, the reconstruction of the web is the only way to get home . . . What has the young man Ryerson to say about that?"

"Don't know. I sent him off to check the manifest and then look over the stuff the ship actually carries. He's been gone a long time, but—"

"I understand," said Nakamura. "It is not easy to face a death sentence when one is young."

Maclaren nodded absently and returned his gaze to the scribbled data sheets in one hand. After a moment, Nakamura cleared his throat and said awkwardly: "Ah . . . I beg your pardon . . . about the affair of Engineer Sverdlov—"

"Well?" Maclaren didn't glance up from the figures. He had a lot of composure of his own to win back.

The fact is, he thought through a hammer-beat in his temples, *I am the man afraid. Now that there is nothing I can do, only a cold waiting until word is given me whether I can live or must die . . . I find that Terangi Maclaren is a coward.*

Sickness was a doubled fist inside his gullet.

"I am not certain what, er, happened," stumbled Nakamura, "and I do not wish to know. If you will be so kind . . . I hope you were not unduly inconvenienced—"

"No. It's all right."

"If we could tacitly ignore it. As I think he has tried to do. Even the best men have a breaking point."

I always knew that there must one day be an end to white sails above green water, and to wine, and No *masks, and a woman's laughter. I had not expected it yet.*

"After all," said Nakamura, "we must work together now."

"Yes."

I had not expected it a light-century from the home of my fathers. My life was spent in having fun, and now I find that the black star has no interest at all in amusing me.

"Do you know yet what happened?" asked Nakamura. "I would not press you for an answer, but—"

"Oh, yes," said Maclaren. "I know."

Beneath a scrapheap of songs and keels, loves and jokes and victories, which mattered no longer but would not leave him, Maclaren found his brain working with a startling dry clarity. "I'm not sure how much we can admit to the others," he said. "Because this could have been averted, if we'd proceeded with more caution."

"I wondered a little at the time." Nakamura laughed again. "But who would look for danger around a . . . a corpse?"

"Broadened spectrum lines mean a quickly rotating star," said Maclaren. "Since the ship was not approaching in the equatorial plane, we missed the full Doppler effect, but we might have stopped to think. And tripled lines mean a Zeeman splitting."

"Ah." Nakamura sucked in a hiss of air. "Magnetism?"

"The most powerful bloody magnetic field ever noticed around any heavenly body," said Maclaren. "Judging from the readings I get here, the polar field is . . . oh, I can't say yet. Five, six, seven thousand gauss—somewhere on that order of magnitude. Fantastic! Sol's field is only fifty-three gauss. They don't ever go much above two thousand. Except here."

He rubbed his chin. "Blackett effect," he went on. The steadiness of his words was a faintly pleasing surprise to him. "Magnetic field is directly related to angular velocity. The reason no live sun has a field like this dead thing here is that it would have to rotate too fast. Couldn't take the strain; it would go whoomp and scatter pieces of star from hell to tiffin." An odd, perverse comfort in speaking lightly: a lie to oneself, persuading the subconscious mind that its companions were not doomed men and a black sun, but an amorous girl waiting for the next jest in a Citadel tavern. "As this star collapsed on itself, after burning out, it had to spin faster, d' you see? Conservation of angular momentum. It seems to have had an unusual amount to start with, of course, but the rotational speed is chiefly a result of its degenerate state. And that same super-density allows it to twirl with such indecent haste. You might say the bursting strength is immensely greater."

"Yes," said Nakamura. "I see."

"I've been making some estimates," said Maclaren. "It didn't actually take a very strong field to wreck us. We could easily have been protected against it. Any ion-drive craft going close to a planet is—a counter-magnetic circuit with a feedback loop—elementary. But naturally, these big ships were not meant to land anywhere. They would certainly never approach a live sun this close, and the possibility of this black dwarf having such a vicious magnetism . . . well, no one ever thought of it."

He shrugged. "Figure it out yourself, Captain Nakamura. The old H, e, v formula. A proton traveling at three-fourths *c* down a hundred-meter tube is deflected one centimeter by a field of seven one-hundredths gauss. We entered such a field at a million kilometers out, more or less. A tenuous but extremely energetic stream of ionized gas hit the outermost accelerator ring. I make the temperature equivalent of that velocity to be something like three million million degrees Absolute, if I remember the value of the gas constant correctly. The closer to the star we got, the stronger field we were in, so the farther up the ions struck."

"Of course," finished Maclaren in a tired voice, "all these quantities are just estimates, using simple algebra. Since we slanted across the magnetic field, you'd need a vectorial differential equation to describe exactly what happened. You might find occasion to change my figures by a factor of five or six. But I think I have the general idea."

"Yes-s-s," said Nakamura, "I think you do."

They hung side by side in dimness and looked out at the eye-hurting bright stars.

"Do you know," said Maclaren, "there is one sin which is punished with unfailing certainty, and must therefore be the deadliest sin in all time. Stupidity."

"I am not so sure." Nakamura's reply jarred him a little, by its sober literal-mindedness. "I have known many . . . well, shall I call them unintellectual people . . . who lived happy and useful lives."

"I wasn't referring to that kind of stupidity." Maclaren went through the motions of a chuckle. "I meant our own kind. Yours and mine. We bear the guilt, you know. We should have stopped and thought the situation over before rushing in. I did want to approach more slowly, measuring as we went, and you overruled me."

"I am ashamed," said Nakamura. He bent his face toward his hands.

"No, let me finish. I should have come here with a well-thought-out program in mind. I gave you no valid reasons *not* to establish a close-in orbit at once. My only grumble was that you wouldn't allow me time to take observations as we went toward the star. You were perfectly justified, on the basis of the information available to you— Oh, the devils take it! I bring this up only so you'll know what topics to avoid with our shipmates—who must also bear some of the blame for not thinking—because we can't afford quarrels." Maclaren felt his cheeks crease in a sort of grin. "I have no interest in the guilt question anyway. My problem is strictly pragmatic: I want out of here!"

Ryerson emerged from the living-quarter screen. Maclaren saw him first as a shadow. Then the young face came so near that he could see the eyes unnaturally bright and the lips shaking.

"What have you found, Dave?" The question ripped from him before he thought.

Ryerson looked away from them both. Thickly: "We can't do it. There aren't enough replacement parts to make a f-f-functioning . . . a web—we can't."

"I knew that," said Nakamura. "Of course. But we have instruments and machine tools. There is bar metal in the hold, which we can shape to our needs. The only problem is—"

"Is where to get four kilos of pure germanium!" Ryerson screamed it. The walls sneered at him with echoes. "Down on that star, maybe?"

IX

Square and inhuman in a spacesuit, Sverdlov led the way through the engineroom air lock. When Ryerson, following, stepped forth onto the ship's hull, there was a moment outside existence.

He snatched for his breath. Alien suns went streaming past his head. Otherwise he knew only blackness, touched by meaningless dull splashes. He clawed after anything real. The motion tore him loose and he went spinning outward toward the dead star. But he felt it just as a tide of nausea, his ears roared at him, the scrambled darks and gleams made a wheel with himself crucified at the hub. He was never sure if he screamed.

The lifeline jerked him to a halt. He rebounded, more slowly. Sverdlov's sardonic voice struck his earphones: "Don't be so jumpy next time, Earthling," and there was a sense of direction as the Krasnan began to reel him in.

Suddenly Ryerson made out a pattern. The circle of shadow before him was the hull. The metallic shimmers projecting from it . . . oh, yes, one of the auxiliary tank attachments. The mass-ratio needed to reach one-half *c* with an exhaust velocity of three-fourths *c* is 4.35—relativistic formulas apply rather than the simple Newtonian exponential — and this must be squared for deceleration. The *Cross* had left Sol with a tank of mercury on either side, feeding into the fuel deck. Much later, the empty containers had been knocked down into parts of the aircraft now stowed inboard.

Ryerson pulled his mind back from the snugness of engineering data. Beyond the hull, and around it, behind him, for X billion light-years on all sides, lay the stars. The nearer ones flashed and glittered and stabbed his eyes, uncountably many. The outlines they scrawled were not those Ryerson remembered from Earth: even the recognizable constellations, like Sagittarius, were distorted, and he felt that as a somehow ghastly thing, as if it were his wife's face which had melted and run. The farther stars blent into the Milky Way, a single clotted swoop around the sky, the coldest color in all reality. And yet farther away, beyond a million light-years, you could see more suns—a few billions at a time, formed into the tiny blue-white coils of other galaxies.

Impact jarred Ryerson's feet. He stood erect, his bootsoles holding him by a weak stickiness to the plastic hull. There was just enough rotation to make the sky move slowly past his gaze. It created a dim sense of hanging head down; he thought of ghosts come back to the world like squeaking bats. His eyes sought Sverdlov's vague, armored shape. It was so solid and ugly a form that he could have wept his gratitude.

"All right," grunted the Krasnan. "Let's go."

They moved precariously around the curve of the ship. The long thin frame-sections lashed across their backs vibrated to their cautious footfalls. When they reached the lattice jutting from the stern, Sverdlov halted. "Show you a trick," he said. "Light doesn't diffuse in vacuum, makes it hard to see an object in the round, so—" He squeezed a small plastic bag with one gauntleted hand. His flashbeam snapped on, to glow through a fine mist in front of him. "It's a heavy organic liquid. Forms droplets which hang around for hours before dissipating. Now, what d' you think of the transceiver web?"

Ryerson stooped awkwardly, scrambled about peering for several minutes, and finally answered: "It bears out what you reported. I think all this can be repaired. But we'll have to take most of the parts inboard, perhaps melt them down—re-machine them, at least. And we'll need wholly new sections to replace what boiled away. Have we enough bar metal for that?"

"Guess so. Then what?"

"Then—" Ryerson felt sweat form beneath his armpits and break off in little globs. "You understand I am a graviticist, not a mattercasting engineer. A physicist would not be the best possible man to design a bridge; likewise, there's much I'll have to teach myself, to carry this out. But I can use the operating manual, and calculate a lot of quantities afresh, and . . . well . . . I think I could recreate a functioning web. The tuning will be strictly cut-and-try: you have to have exact resonance to get any effect at all, and the handbook assumes that such components as the distortion oscillator will have precise, standardized dimensions and crystal structure. Since they won't—we have not the facilities to control it, even if I could remember what the quantities are—well, once we've rebuilt what looks like a workable web, I'll have to try out different combinations of settings, perhaps for weeks, until . . . well, Sol or Centauri or . . . or any of the stations, even another spaceship . . . resonates—"

"Are you related to a Professor Broussard of Lomonosov Academy?" interrupted the other man.

"Why, no. What—"

"You lecture just like he used to. I am not interested in the theory and practice of mattercasting. I want to know, can we get home?"

Ryerson clenched a fist. He was glad that helmets and darkness hid their two faces. "Yes," he said. "If all goes well. And if we can find four kilos of germanium."

"What do you want that for?" Sverdlov asked.

"Do you see those thick junction points in the web? They are, uh, you might call them giant transistors. Half the lattice is gone: there, the germanium was simply whiffed away. I do know the crystallo-chemical structure involved. And we can get the other elements needed by cannibalizing, and there is an alloying unit aboard which could be adapted to manufacture the transistors themselves. But we don't have four spare kilos of germanium aboard."

Sverdlov's tone grew heavy with skepticism: "And that balloon head Maclaren means to find a planet? And mine the stuff?"

"I don't know—" Ryerson wet his lips. "I don't know what else we can do."

"But this star went supernova!"

"It was a big star. It would have had many planets. Some of the outermost ones . . . if they were large to start with . . . may have survived."

"Ha! And you'd hunt around on a lump of fused nickel-iron, without even a sun in the sky, for germanium ore?"

"We have an isotope separator. It could be adapted to . . . I haven't figured it out yet, but— For God's sake!" Ryerson found himself screaming. "What else can we do?"

"Shut up!" rapped Sverdlov. "When I want my earphones broken I'll use a hammer."

He stood in a swirl of golden fog, and the gray-rimmed black eye of the dead star marched behind him. Ryerson crouched back, hooked into the framework and waiting. At last Sverdlov said: "It's one long string of ifs. But a transistor doesn't do anything a vacuum tube can't." He barked a laugh. "And we've got all the vacuum we'll ever want. Why not design and make the equivalent electronic elments? Ought to be a lot easier than—repairing the accelerators, and scouring space for a planet."

"Design them?" cried Ryerson. "And test them, and redesign them, and— Do you realize that on half rations we have not quite six months' food supply?"

"I do," said Sverdlov. "I feel it in my belly right now." He muttered a few obscenities. "All right, then. I'll go along with the plan. Though if that clotbrain of a Nakamura hadn't—"

"He did the only thing possible! Did you *want* to crash us?"

"There are worse chances to take," said Sverdlov. "Now what have we got, but six months of beating our hearts out and then another month or two to die?" He made a harsh noise in the radiophone, as if wanting to spit. "I've met Sarai settlers before. They're worse than Earthlings for cowardice, and nearly as stupid."

"Now, wait—" began Ryerson. "Wait, let's not quarrel—"

"Afraid of what might happen?" jeered Sverdlov. "You don't know your friend Maclaren's dirty-fighting tricks, do you?"

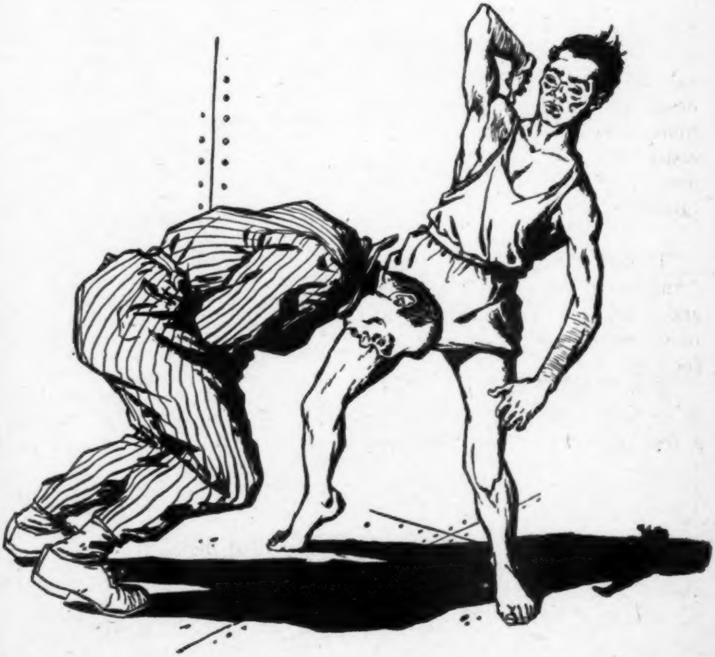
The ship whirled through a darkness that grew noisy with Ryerson's uneven breathing. He raised his hands against the bulky robot shape confronting him. "Please," he stammered. "Now wait, wait, Engineer Sverdlov." Tears stung his eyes. "We're all in this together, you know."

"I wondered just when you'd be coming up with that cliché," snorted the Krasnan. "Having decided it would be oh, so amusing to tell your society friends, how you spent maybe a whole month in deep space, you got me yanked off the job I really want to do, and tossed me into a situation you'd never once stopped to think about, and wrecked us all—and now you tell me, 'We're all in this together!' " Suddenly he roared his words: "You mangy son of a muck-eating cockroach, I'll get you back—not for your sake, nor for your wife's—for my own planet, d' you hear? They need me there!"

It grew very still. Ryerson felt how his heartbeat dropped down to normal, and then still further, until he could no longer hear his own pulse.

His hands felt chilly and his face numb. A far and terrified part of him thought, *So this is how it feels, when the God of Hosts lays His hand upon a man,* but he stared past Sverdlov, into the relentless white blaze of the stars, and said in a flat voice:

"That will do. I've heard the story of the poor oppressed colonies before now. I think you yourself are proof that the Protectorate is better than you deserve. As for me, I never saw a milii of this supposed extortion from other planets: my father worked his way up from midshipman to captain, my brothers and I went through the Academy on merit, as citizens of the poorest and most overcrowded world in the universe. Do you imagine you know what competition is? Why, you blowhard clodhopper, you wouldn't last a week on Earth. As a matter of fact, I myself had grown tired of the struggle. If it weren't for this wretched expedition, my wife and I would have started for a new colony next week. Now you make me wonder if it's wise. Are all colonials like you—just barely



brave enough to slander an old man when they're a safe hundred light-years away?"

Sverdlov did not move. The slow spin of the *Cross* brought the black star into Ryerson's view again. It seemed bigger, as the ship swooped toward periastron. He had a horrible sense of falling into it. *Thou, God, watchest me,* with the cold ashen eye of wrath. The silence was like a membrane stretched close to ripping.

Finally, very slow, the bass voice came. "Are you prepared to back up those words, Earthling?"

"Right after we finish here!" shouted Ryerson.

"Oh." A moment longer. Then: "Forget it. Maybe I did speak out of turn. I've never known an Earthman who wasn't . . . an enemy of some kind."

"Did you ever try to know them?"

"Forget it, I said. I'll get you home. I might even come around one day and say hello, on your new planet. Now let's get busy here. Our first job is to start the accelerators operating again."

The weakness which poured through David Ryerson was such that he wondered if he would have fallen under gravity. *Oh, Tamara,* he thought, *be with me now*. He remembered how they had camped on a California beach . . . had it all to themselves, no one lived in the deserts eastward . . . and the gulls had swarmed around begging bread until both of them were helpless with laughter. Now why should he suddenly remember that, out of all the times they had had?

X

When the mind gave up and the mathematics became a blur, there was work for Maclaren's hands. Sverdlov, and Ryerson under him, did the machine-tool jobs; Nakamura's small fingers showed such delicacy that he was set to drawing wire and polishing control-ring surfaces. Maclaren was left with the least skilled assignment, least urgent because he was always far ahead of the consumption of his product: melting, separating, and re-alloying the fused salvage from ion accelerators and transceiver web.

But it was tricky in null-gee. There could not be any significant spin on the ship or assembly, out on the lattice, it would have become too complicated for so small a gang of workers. Coriolis force would have created serious problems even for the inboard jobs. On the other hand, weightless melt had foul habits. Maclaren's left arm was still bandaged, the burn on his forehead still a crimson gouge.

It didn't seem to matter. When he looked in a mirror, he hardly recognized his face. There hadn't been much physical change yet, but the expression was a stranger's. And his life had narrowed to these past weeks, behind them lay only a dream. In moments when there was nothing else to do he might still play a quick chess game with Sverdlov, argue the merits of *No* versus Kabuki with Nakamura, or shock young Ryerson by a well-chosen dirty limerick. But thinking back, he saw how such times had become more and more sparse. He had quit trying to make iron rations palatable, when his turn in the galley came up; he had not sung a ballad for hundreds of the *Cross'* black-sun years. He shaved by the clock and hung onto fastidiousness of dress as pure ritual, the way Nakamura contemplated his paradoxes or Ryerson quoted his Bible or Sverdlov thumbed through his nude photographs of past mistresses. It was a way of telling yourself, *I am still alive.*

There came a moment when Maclaren asked what he was doing other than go through the motions of survival. That was a bad question.

"You see," he told his mirror twin, "it suggests a further inquiry: Why? And that's the problem we've been dodging all our mutual days."

He stowed his electric razor, adjusted his tunic, and pushed out of the tiny bathroom. The living section was deserted, as it had been most of the time. Not only were they all too busy to sit around, but it was too narrow.

Outside its wall, he moved through the comfort of his instruments. He admitted frankly that his project of learning as much as possible of the star was three-quarters selfish. It was not really very probable that exact knowledge of its atmospheric composition would be of any use to their escape. But it offered him a chance, for minutes at a time, to forget where he was. Of course, he did not admit the fact to anyone but himself. And he wondered a little what reticences the other men had.

This time he was not alone. Nakamura hovered at an observation port. The pilot's body was outlined with unwavering diamond stars. But as the dead sun swung by, Maclaren saw him grow tense and bring a hand toward his eyes, as if to cover them.

He drifted soundlessly behind Nakamura. "Boo," he said.

The other whirled around in air, gasping. As the thresh of arms and legs died away, Maclaren looked upon terror.

"I'm sorry!" he exclaimed. "I didn't think I'd startle you."

"I . . . it is nothing." Nakamura's brown gaze held some obscure beggary. "I should not have— It is nothing."

"Did you want anything of me?" Maclaren offered one of his last cigarettes. Nakamura accepted it blindly, without even saying thanks. *Something is very wrong with this lad,* thought Maclaren. Fear drained in through the glittering viewport. *And he's the only pilot we've got.*

"No. I had . . . I was resting a few moments. One cannot do precision work when . . . tired . . . yes-s-s." Nakamura's hunger-gaunted cheeks caved in with the violence of his sucking on the tobacco. A little crown of sweat-beads danced around his head.

"Oh, you're not bothering me."

Maclaren crossed his legs and leaned back on the air. "As a matter of fact, I'm glad of your company. I need someone to talk with."

Nakamura laughed his meaningless laugh. "We should look to you for help, rather than you to us," he said. "You are the least changed of us all."

"Oh? I thought I was the most affected. Sverdlov hankers for his women and his alcohol and his politics. Ryerson wants back to his shiny new wife and his shiny new planet. You're the local rock of ages. But me—" Maclaren shrugged. "I've nothing to anchor me."

"You have grown quieter, yes." The cigarette in Nakamura's hand quivered a little, but his words came steadily now.

"I have begun to wonder about things." Maclaren scowled at the black sun. By treating it as a scientific problem, he had held at arm's length the obsession he had seen eating at Ryerson—who grew silent and large-eyed and reverted to the iron religion he had once been shaking off—and at Sverdlov, who waxed bitterly profane. So far, Maclaren had not begun thinking of the star as a half-alive malignancy. But it would be all too easy to start.

"One does, sooner or later." Nakamura's tone held no great interest. He was still wrapped up in his private horror, and that was what Maclaren wanted to get him out of.

"But I don't wonder efficiently. I find myself going blank, when all I'm really doing is routine stuff and I could just as well be thinking at my problems."

"Thought is a technique, to be learned," said Nakamura, "just as the uses of the body—" He broke off. "I have no right to teach. I have failed my own masters."

"I'd say you were doing very well. I've envied you your faith. You have an answer."

"Zen does not offer any cut-and-dried answers to problems. In fact, it tries to avoid all theory. No human system can comprehend the infinite real universe."

"I know."

"And that is my failure," whispered Nakamura. "I look for an explanation. I do not want merely to be. No, that is not enough . . . out here, I find that I want to be justified."

Maclaren stared into the cruelty of heaven. "I'll tell you something," he said. "I'm scared spitless."

"What? But I thought—"

"Oh, I have enough flip retorts to camouflage it. But I'm as much afraid to die, I'm struggling as frantically and with as little dignity, as any trapped rat. And I'm slowly coming to see why, too. It's because I haven't got anything but my own life—my own minute meaningless life of much learning and no understanding, much doing and no accomplishing, many acquaintances and no friends—it shouldn't be worth the trouble of salvaging, should it? And yet I'm unable to see any more in the entire universe than just that: a lot of scurrying small accidents of organic chemistry, on a lot of flyspeck planets. If things made even a little sense, if I could see there was anything at all more important than this bunch of mucous membranes labeled Terangi Maclaren . . . why, then there'd be no reason to fear my own termination. The things that mattered would go on."

Nakamura smoked in silence for a while. Maclaren finished his own cigarette in quick nervous puffs, fought temptation, swore to himself and lit another.

"I didn't mean to turn you into a weeping post," he said. And he thought: *The hell I didn't. I fed you your psychological medicine right on schedule. Though perhaps I did make the dose larger than planned.*

"I am unworthy," said Nakamura. "But it is an honor."

He stared outward, side by side with the other man. "I try to reassure myself with the thought that there must be beings more highly developed than we," he said.

"Are you sure?" answered Maclaren, welcoming the chance to be impersonal. "We've never found any that were even comparable to us. In the brains department, at least. I'll admit the Van Mannen's abos are more beautiful, and the Old Thothians more reliable and sweet-tempered."

"How much do we know of the galaxy?"

"Um-m-m . . . yes."

"I have lived in the hope of encountering a truly great race. Even if they are not like gods—they will have their own wise men. They will not look at the world just as we do. From each other, two such peoples could learn the unimaginable, just as the high epochs of Earth's history came when different peoples interflowed. Yes-s-s. But this would be so much more, because the difference is greater. Less conflict. What reason would there be for it? And more to offer, a billion years of separate experience as life forms."

"I can tell you this much," said Maclaren, "the Protectorate would not like it. Our present civilization couldn't survive such a transfusion of ideas."

"Is our civilization anything so great?" asked Nakamura with an unwonted scornfulness.

"No. I suppose not."

"We have a number of technical tricks. Doubtless we could learn more from such aliens as I am thinking of. But what we would really learn that mattered—for this era of human history lacks one—would be a philosophy."

"I thought you didn't believe in philosophies."

"I used a wrong word. I meant a *do*—a way. A way of . . . an attitude? That is what life is for, that is your 'Why'—it is not a mechanical cause-and-effect thing, it is the spirit in which we live."

Nakamura laughed again. "But hear the child correcting the master! I, who cannot even follow the known precepts of Zen, ask for help from the unknown! Were it offered me, I would doubtless crawl into the nearest worm-hole."

And suddenly the horror flared up again. He grabbed Maclaren's arm. It sent them both twisting around, so that their outraged senses of balance made the stars whirl in their skulls. Maclaren felt Nakamura's grip like ice on his bare skin.

"I am afraid!" choked the pilot. "Help me! I am afraid!"

They regained their floating positions. Nakamura let go and took a fresh cigarette with shaking fingers. The silence grew thick.

Maclaren said at last, not looking toward the Saraian: "Why not tell me the reason? It might relieve you a bit."

Nakamura drew a breath. "I have always been afraid of space," he said. "And yet called to it also. Can you understand?"

"Yes. I think I know."

"It has—" Nakamura giggled. "Unsettled me. All my life. First, as a child I was taken from my home on Earth, across space. And now, of course, I can never come back."

"I have some pull in the Citadel. A visa could be arranged."

"You are very kind. I am not sure whether it would help. Kyoto cannot be as I remember it. If it has not changed, surely I have, yes-s-s? But please let me continue. After a few years on Sarai, there was a meteor fall which killed all my family except my brother. A stone from space, do you see? We did not think of it that way, then. The monastery raised us. We got scholarships to an astronautical academy. We made a voyage together as cadets. Have you heard of the *Firdawzi* disaster?"

"No, I'm afraid not." Maclaren poured smoke from his mouth, as a veil against the cosmos.

"Capella is a GO star like Sol, but a giant. The *Firdawzi* had been long at the innermost planet of the system, a remote-controlled survey trip. The radiations caused a metal fatigue. No one suspected. On our cruise, the ship suddenly failed. The pilot barely got us into an orbit, after we had fallen a long way toward Capella. There we must wait until rescue came. Many died from the heat. My brother was one of them."

Stillness hummed.

"I see," said Maclaren at last.

"Since then I have been afraid of space. It rises into my consciousness from time to time." Maclaren stole a glance at Nakamura. The little man was lotus-postured in midair, save that he stared at his hands and they twisted together. Wretchedness overrode his voice. "And yet I could not stop my work either. Because out in space I often seem to come closer to . . . oneness . . . that which we all seek, what you have called understanding. But here, caught in this orbit about this star, the oneness is gone and the fear has grown and grown until I am afraid I will have to scream."

"It might help," said Maclaren.

Nakamura looked up. He tried to smile. "What do you think?" he asked.

Maclaren blew a meditative cloud of smoke. Now he would have to pick his words with care—and no background or training in the giving of succor—or lose the only man who could pull this ship free. Or lose Nakamura: that aspect of it seemed, all at once, more important.

"I wonder," MacLaren murmured, "even in an absolutly free society, if any such thing could exist— I wonder if every man isn't afraid of his bride."

"What?" Nakamura's lids snapped apart in startlement.

"And needs her at the same time," said Maclaren. "I might even extend it beyond sex. Perhaps fear is a necessary part of anything that matters. Could Bach have loved his God so magnificently without being inwardly afraid of Him? I don't know."

He stubbed out his cigarette. "I suggest you meditate upon this," he said lightly. "And on the further fact, which may be a little too obvious for you to have seen, that this is not Capella."

Then he waited.

Nakamura made a gesture with his body. Only afterward, thinking about it, did Maclaren realize it was a free-fall prostration. "Thank you," he said.

"I should thank you," said Maclaren, quite honestly. "You gave me a leg up too, y' know."

Nakamura departed for the machine shop.

Maclaren hung at the viewport a while longer. The rasp of a pocket lighter brought his head around.

Chang Sverdlov entered from the living section. The cigar in his mouth was held at a somehow resentful angle.

"Well," said Maclaren. "How long were you listening?"

"Long enough," grunted the engineer.

He blew cheap, atrocious smoke until his pocked face was lost in it. "So," he asked, "aren't you going to get mad at me?"

"If it serves a purpose," said Maclaren.

"Uh!" Sverdlov fumed away for a minute longer. "Maybe I had that coming," he said.

"Quite probably. But how are the repairs progressing outside?"

"All right. Look here," Sverdlov blurted, "do me a favor, will you? If you can. Don't admit to Ryerson, or me, that you're human—that you're just as scared and confused as the rest of us. Don't admit it to Nakamura, even. You didn't, you know . . . so far . . . not really. We need a, a, a cocky dude of a born-and-bred technic—to get us through!"

He whirled back into the quarters. Maclaren heard him dive, almost fleeing, aft along the shaftway.

TO BE CONCLUDED

THEY'VE BEEN WORKING ON...

BY ANTON LEE BAKER

Computers are wonderful things. They can know a great deal. But they are utterly stupid, of course. A computer can't learn anything at all!

Illustrated by Freas

THESE things *always* begin with paper work. In the faraway home offices, some bright executive figures that the railroad company ought to offer a new service to shippers now that it has computing machines. A policy statement comes out to that effect. Some shipper accepts the offer and demands the service, and the whole thing is dumped onto the shoulders of the man at the operational level.

Marvin Muench.

The warning bell was *ding*-ing lazily, and the Diesel engine was turning over gently, like a cow chewing its cud, as Marvin eased his rig along the siding. With a skill and a pride of workmanship developed during twenty years of railroading, he eased the switch engine forward, nudging the single boxcar ahead of it into position so that the door to the boxcar lay *exactly* alongside the door to the warehouse.

His watch said 11:47. He was ten minutes ahead of his R and S instructions for the day. Beaming with professional pride, he set the engine to idling and stopped the bell.

The slice of apple pie which he abstracted from his lunch pail was up to his wife's usual standard, and since it was a brisk October morning, the dark, steaming coffee from his thermos hit the spot. All was well with his world.

"Trouble, Marv," said his helper, poking his head in through the open door of the cab.

"What trouble? Ain't you got that car uncoupled yet?"

"That's the trouble. The door to the boxcar ain't in front of the door to the warehouse."

"Now listen here. I've been railroadin' for twenty years, and—"

"I know, Marv," interrupted the younger man, "but you better come out here and take a look."

"Humph," grunted Marvin Muench. With a this-better-be-good-now attitude, he ritualistically put his pie and coffee on a cowling that vibrated slightly with each of the tremors from the idling engine. He dropped to the ground beside the cab a trifle arthritically, and his helper trotted ahead of him as he walked along the tracks.

He found that the door to the boxcar was lined up *exactly* with the door to the warehouse, as any fool could plainly see.

"What's the trouble?" he asked.

"Look," his helper pointed.

He looked at the open door of the boxcar. He was confronted with a forest sideways.

The paperwork on this car had said that it contained one carload of operatic scenery. What he could see of the car's contents was a flat of painted canvas, stretched over some kind of wooden framework, and painted to look like trees upon trees. The trees were all growing horizontally, a defect that would be remedied by unloading this piece of scenery and setting it upon its bottom instead of upon its side.

"Santa cantata smorfiata!" came an

irate voice from under the boxcar. *"Per diavol parlata! Perduta è l'opera!"*

"Huh?" queried Marvin Muench.

The two men who emerged from under the boxcar were singular. Both of them.

One was wearing the loudest red silk shirt that Marvin had ever seen. He was a short, stocky, evil-looking individual with a luxuriant mustache. Around his throat he wore a blue bandanna to contrast with his red shirt. "How we-a gonna putta the scenery?" he asked.

The other man was one whom Marvin recognized. He had been a section hand with the railroad a few years back. He was wearing a blue work shirt, and doubtless out of perversity, a red bandanna around his neck.

Marvin asked blue shirt, "What's the trouble?"

"He says he can't unload the scenery."

"Can't-a putta the scenery," effused the red-shirted one. *"Santa Madonna,* the prima donna, she quit, *il tenore,* the costume no fit, the basso, he go and get lit, the costumes-a they no come, the maestro, he bust-a blood vessel, and now-a the scenery no come outta the door. You give him a twist, ha?"

"Huh?"

"Turn him around. Don't-a you understand-a me? The boxcar, he must turn around."

Marvin Muench scratched his head. Apple pie and coffee were waiting, and he didn't want to get behind in his R and S—Routing and Scheduling—instructions. "Uncouple that boxcar," he ordered his helper in a low voice, "and let's get out of here." He started to walk back to the cab.

"You cannot-a leave it-a here. You cannot-a leave it-a here." The red-shirted man's voice rose to a theatrical hysteria. "Maestro! *Padrone! Conduttore!"* He was plucking at Marvin's sleeve. "You gotta turn him around."

"Mister," Marvin turned and said sternly, "I never heard of such a thing. When you get a boxcar, you don't have it turned around. You take him the way you get him and you unload him. Haven't you gotta no crew?"

"I gotta da crew. *Sì*. But the scenery, she's-a too big. Can't-a get him outta the door. You twist him, ha?"

"Mister, I can't turn this boxcar around. I'm due back at the marshaling yards at 12:25. Besides, you can't just turn a freight car around. They aren't built that way."

"You got to turn him around! You gotta give him a twist! It says so right here in the contract. Giusepp'-a you bring him-a contract."

Blue shirt obediently trotted into the warehouse and out again, carrying a paper. There it was, typed right in on the contract form, quote, scenery is to be delivered in such a position that it can be unloaded with utmost facility, unquote. Since the railroad had started having its freight operations run by its new electronic Brain, the boys in the office were getting reckless with what they promised.

"Why can't you unload him?" asked Marvin.

"The scenery, she's-a too big. Can't get him outta the door."

"Why don't you use the other door on the other side of the boxcar?"

"Is-a no room. I show you."

The red-shirted man climbed under the boxcar, and, strictly against safety regulations, Marvin followed. On the far side of the car, there was a solid brick wall, built so close to the tracks that the two men didn't even have room to stand up between it and the side of the car. Shuddering, Marvin went back under the car, and the red-shirted man followed.

Well, thought Marvin, the contract said, quote, unloaded with utmost facility, unquote; and the boxcar certainly couldn't have been unloaded with any facility the way it was. One side of the car was too close to a brick wall to leave enough room for an unloading gang to work in, and the other side of the car was jammed from within by the big flats of scenery so that nothing could come out the door. A fine impasse.

"O.K., boss," said Marvin. "We take him down to the shop and we give him a little twist."

So he took the engine down, nudging the boxcar along ahead of it. He was supposed to pick up another boxcar on the way into the yards from the Ajax Company siding, and then another one from the spur at the Bejax Company, and a third one from the Bison outfit on Bluff Street.

Naturally, when he pulled past the checking tower with one boxcar load of operatic scenery, nothing from Ajax, nothing from Bejax, and, what was worse, nothing from Bison, Old Harry, the supervisor on duty, gave him the dickens.

"What kind of monkey business is this?" exploded Old Harry. "Where in the nether regions did that hermaphroditic boxcar come from?"

A quiet answer turneth away wrath. Marvin answered quietly. "Contract, Harry. Man has a contract, says we gotta deliver this boxcar to him other-end-to."

"Why do we have to deliver it other-end-to?"

"So's he can unload it. Scenery won't come outta that door, and he can't unload from the other side, 'cause there isn't space across the tracks from his warehouse for the unloading gang to work."

Harry scratched his head and contemplated the sideways-growing forest. "That's his problem," he concluded.

"No, it's our problem. His contract says so."

"What does it say? Have you got a copy?"

Marvin took a deep breath. "No I don't, but he showed it to me. It said, 'Scenery must be delivered in such a way that it can be unloaded with utmost facility,' or something like that."

"Since when," blustered Old Harry, "have those misbegotten libertines in the business office been putting out contracts like that?"

"I don't know, Harry, but that is what the contract said, and that is what we gotta live up to."

"Since that electronic brain took over, they act up in the office like they don't have any of their own brains functioning." He mopped his brow. "Oh, well . . . *when* did that contract say we had to deliver this boxcar?"

"Today."

"O.K., Marv," Harry decided. "I'll tell you what we're going to do. You just leave that biological carload of opera scenery right here where it is now, and I will get one of the other switch engines to take care of it later. Right now you're a half hour behind in your R and S time. Get back to Ajax and don't let me see that engine of yours again until you've got those other three loads that you're supposed to bring in."

"O.K., Harry."

And thus, Marvin uncoupled the load of scenery and forgot about it until later in the afternoon. It was just after three p.m., and Marvin had almost caught up with his R and S time, when Harry signaled him to stop as he was pulling by the checking tower.

Harry gave Marvin his new R and S orders at 3:12 p.m.

Under the new R and S setup, complete data on every load in every boxcar, on every switch engine, on every train, in short, all the detail data on everything involving rail operations, was fed into a master elctronic "Brain" in each of the large cities served by the railroad.

This "Brain" is connected to the local branch office of all the other railroads, and it also gets information from all the other "Brains" in all the other major cities in the United States and Canada.

This system is supposed to keep track of all the orders and loads and everything that travels by rail; so that for the first time since railroading began, the railroads can guarantee delivery times on ordinary freight. A shipper can find out ahead of time exactly when his shipment is going to arrive wherever it is going.

It is the job of the electronic Brain to figure everything out, and make every shipment reach its destination on time.

R and S—Routing and Scheduling—orders come out of the Brain at twelve-hour intervals, and the engineers have approximately three hours leeway.

When Marvin received his new R and S orders from Harry, he reflected that there was just one thing that they didn't figure into the Brain when they built it. That was how to indicate which-end-to a boxcar ought to be when it gets to where it's going.

Well anyway, the Brain had ordered, among other things, that Marvin should, ". . . Take that . . . boxcar out to siding number 57Y24 and deliver it there. Pick up the empty boxcar at 9:42 p.m. . . ." Of course, that last would have been after his shift.

Marvin blinked. "Are you sure," he asked Old Harry, "that this is the order you want me to obey?"

Old Harry answered. "Marv," he said, "I have been in railroading for twenty-seven and one-half years, and I know one thing for sure, and that is that when Mr. Lemnon orders something done his way, you do it his way. My orders are to make those engines move the way that the Brain says that they should move. The Brain says take this boxcar out to such and such a siding and deliver it there. Contract or no contract, that is the order the Brain says, and one of the functions of the Brain is to minimize the railroad's liability from contract failures."

"O.K., Harry," Marvin said, "you're the boss, but you know good and well what will happen."

Harry didn't say anything. He just gave Marvin a dirty look as the latter opened the throttle and took off.

Well, same scene as that morning. The old Italian was standing there in a red silk shirt saying, "Why you no bring-a my scenery? Huh, why you no bring-a my scenery? Dress rehearsal, she is ruin! Ruin! *Absolutamente* ruin!"

Marvin didn't tell him anything. He just looked him right in the eye, uncoupled the boxcar, and got back in the cab and let out the throttle, and went about his business according to the Brain's R and S orders.

The last Marvin heard of the Italian, he was gesticulating and bubbling, "I'll sue you. *Santo Diavolo,* how I'll sue you! Our performance, she is ruin, our scenery, we can't-a getta him outta-da train. *Santa Maria . . .*"

And then Marvin turned the corner.

About 5:00 p.m., Harry caught him chugging by the checking tower, signaled him to stop, and handed him a memo which he had just got personally from Mr. Lemnon's office. It said, "Detach switch engine No. 84 (that was his rig) from our fleet of rolling stock. Do not let it bring in its part of our equipment; and send the engineer (pay him overtime) out to pick up that opera company boxcar and take it down to the roundhouse and turn it around. After all, Harry, you've been in railroading for twenty-seven and one-half years and you should know how to handle a little thing like that."

They did as they were told.

Of course, there was just one hitch. All of the tracks are taken up in the calculations of the Brain. When they detached one engine from the Brain's outfit, and before they sent it any place, they should have made the Brain forget about some of the tracks, too. Marvin started down Track 5, because he knew that that one was the least commonly used.

Well—in the first place, since the

electronic Brain knows where every piece of rolling stock is, the electronic Brain flashes the warnings at automobile crossings, bridges, et cetera. Since the Brain didn't know about Marvin's rig any more, he had to stop and blow his whistle at every crossing. Boy, did those automobile drivers swear when they saw him coming.

Well, about ten blocks south of the worst street crossing, he saw Rig No. 36 (that would be the rig that old Shorty Blakely was running), coming at him at about twenty-five miles an hour, full tilt. He stopped, blew the whistle, and actually had to throw the engine into reverse and back down the track to get away from him.

Finally old Shorty woke up to what in the heck was coming off, and there the two rigs stood, face to face on Track 5. Marvin had to back his rig all the way to the checking tower before he could get off onto a siding and let Shorty's rig into the freight yards.

About this time Old Harry was the color of a ripe beet. But all he said was, "I'll ask the Brain which tracks are going to be clear."

About five minutes later he came off the phone with the information that the Junior Cyberneticist on duty at the "Thalamus" said to hold everything, and he would attempt to find out what tracks were not busy, but in the meantime stay put, since Number 84 (Marvin's rig) had fouled up the Brain three times already today and the resulting changes had forced the railroad to adjust its R and S orders as far away as the next three towns down the line. As a result, deliveries were as much as four hours behind schedule and all the trains were moving faster than normal to catch up and it would not be safe or expedient to have a maverick switch engine on any of the tracks until he could find out which of the tracks would be clear.

Since this was a completely new problem for the Brain to figure out, the Junior Cyberneticist was going to have to call in one of the *Senior* Cyberneticists to help set it up. These electric Brains are fine things for doing just one job, as the Junior Cyberneticist had said, but if it becomes necessary to have them do a different job, it sometimes takes a long time to figure out how to make them change.

Sometimes months.

This being Saturday, all the Senior Cyberneticists were off-duty, and chances were, that none of them could be reached by phone. In the meantime, Marvin could imagine how that Italian must have been screaming for his scenery, because about ten minutes later while he was sitting there with this blasted load of scenery on his caboose, blocking traffic, Old Harry got a call from Mr. Lemnon, personally, saying why was this silly little load of opera scenery interfering with deliveries in four different cities? And why couldn't he get this opera scenery delivered and get Number 84 back into the fleet pronto?

Harry told him about the trouble with the tracks not being clear, and told him that the Brain's technicians were working on it right now, and as soon as somebody with any brains would give him his orders what to do, he'd see that it got done.

Whereupon, Mr. Lemnon said, "Declare an emergency right-of-way and get that scenery to the roundhouse and turn it around and deliver it out to the opera company warehouse where it belongs. After all, Harry, you've been in railroading for twenty-seven and one half-years, and you ought to know how to handle a little thing like that."

"O.K., boss," said Harry, and hung up. He passed on the Word to Marvin, and Marvin started out again. All in all, he figured that Track 5 would be the easiest, but he figured wrong. The Brain had routed no less than three switch engines onto Track 5, so that, traveling with emergency orders as he was, by the time that he got to the roundhouse he had three switch engines and a dozen or so ill-assorted boxcars traveling in front of him.

Well, he ordered the three other rigs onto three separate sidings and got past them that way and got into the roundhouse, still trailing this dysmorphism of a boxcar. He got onto the turntable with his boxcar and got turned around hind-end-to and started out again.

Before he got out of the roundhouse, though, he received new orders from the Brain. The cybernetics boys had figured out a complicated way of turning the boxcar around which would involve using a loop-shaped track approximately ten miles out of town. However, he didn't need this now, so the priority order that they had given him to go there and back was no good. Furthermore, the three engines that had gotten stalled on Track 5 on account of him were out of the positons where the Brain thought they were.

Well, anyway, he chugged into the siding beside the opera company warehouse trailing this scenery caboose, lined the door of this boxcar right up alongside their loading platform, and found that his Italian friend had sent his crew home. He had gone home himself and had locked up the warehouse leaving no one in charge.

By this time it was getting late and he had not eaten dinner and he was getting tired of the whole thing. Well, without any crew, he couldn't get the boxcar unloaded and take the scenery off his hands. The siding was a blind-ended siding and his engine was inside of where the boxcar was, so he couldn't leave the boxcar and back out with the engine. In order to leave the boxcar in and get himself out, he had to somehow get himself around onto the other end of the boxcar. Well, the nearest siding he could do that on was a half mile away up the track, and so he phoned in for orders.

Now, when a man phones in for orders from outside one of the regular yards he doesn't talk to Harry, he talks directly to the cyberneticist in charge of the Brain. By this time, as he later found out, there were three of those double-domes fiddling around trying to figure out what to do with him. He mapped the situation out for them, and, while turning a boxcar hind-end-to was not one of the Brain's normal jobs, switching a switch engine around to the other end of a boxcar, like he now had to do, was.

So they told him that they would integrate his problem into the general computation for that evening and let him know immediately. In the meantime he was to wait right by the phone and not move an inch!

One hour, forty-eight minutes and twenty-three seconds later they phoned and told him to take a half hour off for dinner and then call them back.

It was dark by then, it was late, it was cold, it was Saturday night, and there were no restaurants open, and he had to grab a couple of hamburgers in a tavern near the tracks.

By the time he got back from dinner they had managed to issue a new general computation. Now, mind you, when they do that, it means that every switch engine and every train conductor has got to get new orders—something which they normally only do every twelve hours. And this new general computation wouldn't let him switch places with the boxcar on the nearest siding a half mile away. Oh, no, he had to go to one of the sidings all the way out on Harter Island to do it.

Well, when he got to Harter Island, he found one other thing the Brain hadn't figured on. The siding that he was supposed to use to get around to the other end of this boxcar was on piling over water and had not been used for any purpose for more than a year. The tracks were rusty and the piling did not look safe at all to take the rig out on. However, orders were orders, and he did it. Sure enough the ties gave way under the weight of the engine, spreading the tracks so that there he was, straddled with no tracks to drive on—still dragging that millstone of a boxcar behind.

He called in, and they promised to send the wrecker out. Now the wrecker is something that the Brain knows about, so that when a wrecker has to go from one place to another it can get where it's going. More emergency computations, and more trains being rerouted in four different cities. This was costing the company *money*.

By the time the wrecker got to Harter Island, it was starting to drizzle, and Marvin was still dressed for the day shift. The three-man crew of the wrecker acted very efficiently. They swiftly uncoupled the troublesome boxcar, got a sling of wire ropes around it, and got the sling attached to the crane on the wrecker by means of a heavy cable.

The crane heaved, the boxcar rose into the air, scenery and all, and the cable started to untwist.

The wrecker pulled back onto safe track, and the crane turned to deposit the boxcar on the neighboring track. The law of conservation of angular momentum came into play to assist the twisted cable in turning the boxcar, and by the time the crane set it down on the neighboring spur, it had gently turned through one hundred eighty degrees.

Pulling Marvin's rig back off of the spread rails was only a minute's more work. The wrecker towed him back onto safe track, where he could advance under his own power. He went forward, stopped, threw the switch, backed onto the neighboring spur, and coupled onto the boxcar. He was finally around to the other end of it! Hooray!

But hold everything. The wrecker had turned the boxcar around hind-end-to. Two negatives had made a positive. He was *still* attached to the wrong end of the boxcar. As far as being able to deliver the scenery and unload it was concerned, Marvin was right back where he had started that morning.

But this time, the cybernetics boys were up to his tricks. They had a complicated plan devised for him to use the loop-shaped track ten miles out of town.

However, it was late and it was cold and he had had enough. He was fed up with cybernetic Brains and the brains who man them. He took a drastic step. He requested an employee suggestion blank.

The testimonial dinner in honor of Marvin Muench's retirement from the company was a gala affair. Mr. Lemnon was there, and Marvin felt a little numbed at being suddenly in so much of the limelight.

Of course, there were the gossips who said that the cybernetics boys had had something to do with Marvin's retirement, and there were even those wags who insisted that one of the cyberneticists had been fired over the incident, but these sordid imaginings were both wrong.

Marvin had put in his twenty years, and the gold watch which Mr. Lemnon personally presented him with at the banquet proved it. They also gave him a bonus check and an award medal for the most distinguished employee suggestion of the year, but what pleased Marvin most was the letter, signed by Mr. Lemnon personally, praising him for having saved the company money and for having extricated the railroad from an embarrassing difficulty.

His suggestion, of course, was to the effect that, since the Brain knew about the wrecker wherever it went, and since the wrecker had inadvertently reversed the boxcar, why not have the wrecker *re-reverse* it and then proceed ahead of them down the tracks while the scenery was delivered to the warehouse!

The opera company didn't sue after all. The scenery missed the dress rehearsal, but they unloaded it and trucked it in from the warehouse, and it arrived at the theater in time for the performance. They got the basso sobered up by curtain time, too.

THE END

CARGO...

...FOR COLONY 6

BY CHRISTOPHER ANVIL

Some things are a little hard to explain...even when you really do fully understand them. Like the "gasolinen djinn." And when it comes to something you don't yet fully understand....

Illustrated by van Dongen

COLONEL David Nevv watched the hands of the chronometer line up for the sixth break-point, and remembered General Lawson's warning as if he heard it anew.

"You've got twenty days to get there," said the general, "and for safety, you should make it in twelve. Red Base won't answer our signal, and the last incomplete report from *Vanguard* was that the Flats were sending a big 'friendship delegation' aboard. Now Blue Base tells us the Flats are making overtures," he looked at Nevv wryly, "to send down a geological expedition *with its drill rigs and other heavy equipment*. I've ordered Blue Base to refuse permission and to open fire if the Flats try to come down. Green Base and White Base are on full alert, so for the time being Colony 6 is safe."

"For twenty days?"

". . . If the Flats are cautious. In twenty days Green Base will be too far around in its orbit to give any cover. Blue Base won't come into position for another week. The Colony's only overhead protection will be Red Base, and there's every reason to think the Flats now own Red Base. You've got to get there before Green Base is out of range. We're giving you an AA dreadnought stripped for speed, and the best control-room crew you could possibly have. If you can get in there and get your cargo to Hunsinger before the Flats move in, the Colony's saved. If you don't make it, the Flats will sew it all up before we can get our fleets collected together from all the places that were supposed to be more dangerous. And once they get that far the Flats will cut off everything we're just starting to develop from the Colony outward. The reverberations will shake us for a hundred years."

"Sir, I'll do my best."

"All right," said the general, "but bear one thing more in mind. The Flats were supposed to be friendly, and our manpower in Planning is always limited. We have only a partial set of alternate routes to Colony 6. If the Flats got Red Base intact, they probably got the route maps, too. Every time you break out of subspace, expect a reception committee. If you can't get away, depress the switch for nose turret ten on the firing console. That will destroy the —cargo. We can't let that fall into enemy hands."

Nevv had saluted. The general had returned the salute and gripped Nevv by the hand. And now Nevv watched the chronometer and felt a tightening of his stomach muscles. He glanced to his left, and saw Lieutenant colonel Randolph Hughes, his head invisible in the pilot globe, his hands steady on the manual controls. He glanced over his right shoulder and saw no sign of Lieutenant colonel Philip Mannin, his astrogator. Nevv spoke into the microphone. "Phil, we've got just twenty-one seconds till break-point."

In Nevv's earphone, Mannin's voice said, "Coming. I was just looking over the cargo."

"Nineteen seconds," said Nevv in warning. He heard the metallic click of the latch as Mannin came in. Nevv turned and saw Mannin start to strap himself in his acceleration couch.

"Ready," said Nevv. "Fifteen seconds."

Hughes' voice said "Ready, pilot." A moment later, Mannin said "Ready, astrogator."

The narrow second hand swung up to join the minute and hour hands on the chronometer. For an instant, all three hands were in line. A bell chimed softly. A wash of colors swept away Nevv's view of the control room. He heard the heavy distant clang of the breakpoint gong down in the empty crew's quarters. He felt something cold and soft press on his shoulders, and realized that the command globe had settled in place. Abruptly he seemed to be alone in a blackness lit with brilliant pinpoints of white.

Hughes' voice said, "Here we go. One to the left foreground high. One to the left foreground low. One to the *far* left foreground high—"

As Hughes spoke, bright target disks showing detected spaceships began to spring into view, and gently-curving fine lines traced out to show the ideal potential tracks of projectiles to be hurled against them.

"To the far left background low," said Hughes. "To the far left background high—"

Mannin cut in to say, "Alternate courses." A green line, a yellow line, and a red line appeared as if hanging in space before Nevv's eyes. Each line represented a course to a new breakpoint into subspace, red being the longest course in normal space and green the shortest.

Mannin said, "Green course, eighty-three hours in subspace, minimum; yellow, eighty-six, minimum; red, forty-three minimum. Green, five alternates; yellow, four alternates; red, two alternates. Final breakpoint: green—"

Suddenly Hughes said, "Near right background high! Near right background low!"

Two glaring orange-red marker disks showed up close below to the ship's right rear and close above to the right rear.

"Sewed-up," growled Hughes.

A short purple line appeared directly in front of Nevv's eyes.

Mannin said, "Backtrack route for return to the last breakpoint. We might try another route from there."

Nevv said, "Don't move the ship at all." He swung his hand up and hit the trip-release at the bottom of the command globe. The globe spun up out of the way.

Directly in front of Nevv, the viewscreen flared and lit up, showing a remarkably broad-shouldered individual, with a wide head and wider neck, wearing a bright blue uniform with a yellow sash draped across his broad chest, with three tufts of red on the yellow sash, and a cluster of golden spikes on each shoulder. This officer had small triumphant eyes under bushy brows, and a head of short bristly hair that ran down his neck on either side and vanished under his collar. He watched Nevv like a cat with a bird in its paws and said nothing.

Nevv recognized the insignia of a Flat admiral, and immediately brought his arm up in a precise salute.

A faint frown crossed the Flat's face, and he returned the salute.

Nevv said, "Colonel David R. Nevv, commanding T. S. F. Dreadnought *Prometheus,* requests permission for T. S. F. Vengeance Fleet One to pass in column of dreadnoughts, shipwise."

The Flat's mouth opened slightly and shut again. His eyes darted once to either side of the viewscreen, as if hastily checking instruments, then returned to Nevv. His mouth began to move, and a moment later the translated version of what he said came through: "Colonel, I have received word of no such fleet. Where are the rest of your ships now?"

"Still in subspace, admiral. *Prometheus* is the lead ship in this column."

"May I ask—as the interested representative of a friendly power—what is your destination, and what is your mission?"

"Our ultimate destination is secret, sir," said Nevv. "As for our mission, there have been certain difficulties far out-world of our Colony 6. The flag has been insulted, sir. Low forms of life have attempted to take a mean and treacherous advantage of us. I am sorry, but I am not at liberty to give details. I can only say that our answer to the insult has been long planned and is being carried into effect with the utmost secrecy. Again, sir, I formally request you to give permission for T. S. F. Vengeance Fleet One to pass, in column of dreadnought, shipwise."

The admiral scowled, squinted, then blanked his face and gave a good imitation of earnest sympathy. "I am very sorry, colonel. This region is being used as a . . . er . . . practice mining exercise region, and we simply cannot allow your fleet to go through. If your supreme commander wishes to consult with me when he arrives—"

"Sir," said Nevv earnestly, "I, too, am very sorry. My instructions on this point were explicit. Perhaps I haven't explained myself fully and clearly. Our *flag* has been *insulted*. This is T. S. F. Vengeance Fleet One. The supreme commander is not with this fleet. This is a combined operation, admiral, timed to the second. If *this* fleet is out of timing, it will affect the operations of the others. We have spent too much time and material in preparation to allow this to happen. When the steel blades of the trap slide shut, admiral, they must all bite in at once; otherwise some of the vermin may get away. Admiral, this is an affair of honor. I must tell you, sir, we are going through. And now, admiral, *again* I ask your permission."

The Flat officer took a deep breath, looked directly at Nevv and said in a low hoarse voice, "I am very sorry, colonel, this is a practice mining region, and our ships here constitute, as it were, a region of our own territory. You can understand, colonel. Our own . . . ah . . . honor? Yes, our own honor is involved."

Nevv shook his head. "I'm very sorry, admiral. We've had such good relations with your people before. But we've spent too much time in preparation. We can't sacrifice the timing and the secrecy." He reached out and brought his hand down hard on the "Prepare" bar of the firing console. The battle-stations' gongs back in the empty crew's quarters let go with a tooth-jarring clatter that reverberated in the control room.

Nevv turned to Mannin. "Set up alternate Fleet course to avoid this obstacle." He glanced at Hughes. "Send signal fourteen, 'Sacrifice to avoid delay.' "

Hughes, his face the color of freshly-sliced unripe onions, hit the beam-signal keys twice, then twice again.

Mannin spoke up briskly. "Send Alternate 20-25-25 orange."

"Right," said Hughes. He struck the keys again.

Nevv flipped over the public address switch and pulled the microphone to him. "Men," he said firmly, and multiplied echoes of his voice boomed back to him. "Men, this is the C. O. speaking." His voice roared and reverberated in the empty ship. "Men, we have been slightly delayed, but we are going to blast out a diversion so the Fleet can go through unhindered. There are a number of ships to deal with, but remember, follow your saturation procedures carefully, and don't be overeager for the kill. We want to get the full benefit of these new weapons, and we don't want anybody hogging a target. This is all going down on film, so everyone can be sure he'll get full battle-credits for good square hits and methodical controlling. And lastly, men, remember, every ship burst neatly open here, every clean suckout, every well-placed sun-shot, will put us just that much closer to the *real* enemy. That's all men. Listen for the signal, and no jumping the gun."

On the screen, the Flat admiral put a finger inside his collar, puffed out his cheeks, started to say something, and hesitated.

Nevv put his hand on the firing switch for nose turret ten. He turned to Hughes.

The Flat admiral, speaking rapidly, said, "One moment, colonel. I have just received special instructions from the high officer commanding in this region. You may proceed, but only along a specially marked route—to avoid the mines. One of our ships will mark the route—"

Nevv said courteously, "Thank you, sir. But if you do that, we will be late at our rendezvous. We'll just have to take our chances with the mines." He turned to Hughes. "Course red, colonel."

"Yes, sir," said Hughes. He pulled down the pilot globe. There was a roar and a trembling, and the big ship began to move.

On the screen, the Flat gave a weak smile, nodded with imitation briskness, and broke contact.

All the way to breakpoint into subspace, Nevv could feel a sensation like a faint cold wind across the back of his neck and shoulders.

When they were well on their course in subspace, Hughes ran his fingers over the automatics settings, then shoved up the pilot globe. He looked at Nevv, grinned feebly and said, "I used to think we should make these ships *fully* automatic. But what machine could have gotten us out of *that* mess."

"We aren't home yet," said Nevv dryly. He glanced at Mannin. "How many more breakpoints on this route?"

"Two in, three out," said Mannin.

Nevv considered that. If the Flats were planning a big seizure of space in this direction, and if—as now seemed clear—they had the route maps to Colony 6, no doubt the breakpoints ahead would swarm with warships. Messages would already be snapping back and forth through subspace, and even now, Flat technicians would be hastily setting up sensitive detectors by the thousands. Flat intelligence experts would be huddled over maps and grids, sending hurrying messengers with slips of paper to Flat calculating machines. Sooner or later, some Flat computer was going to flash its lights and unroll a string of symbols that boiled down to, "It's a bluff, probability such-and-such."

The thing to do, Nevv told himself, was to keep that probability from verging on certainty. He drew out a message form and wrote:

"T. S. F. *Prometheus* to T. S. F. V. F. I.: Breaking primary subradiation ban as per Directive Seven rpt Seven B rpt B. Obstacle passed. Advise not repeat not use Reserve Killer Groups this sector to cleanse obstacle-markers. Do repeat do suggest preparatory shift these groups in event unexpected exigency. Entire complement this ship volunteers bait duty at next mousehole.—D. R. Nevv, Colonel, Commanding."

Nevv handed the message to Hughes, and said, "Send it in the old code. If they've got Red Base, they've probably got the code books, too."

"What if they haven't?"

"We've got to take the chance. If we send it in clear, it will be an obvious fake."

Hughes nodded and went to get the old code book.

Mannin said, "I didn't want to trouble you with this before, but what do we have for a cargo?"

"About forty medium-sized crates. What's in them is none of our business."

Mannin scratched his head. "Well— Could you at least tell me if they were specially loaded on?"

"No, the same as usual. In a cargo web. Why do you ask?"

"Do you have a few minutes?"

Nevv scowled and studied his astrogator for a moment. He glanced at the chronometer and saw that he had three hours and twenty-seven minutes till the next breakpoint. "Sure. If it's important."

"It seems important. I don't know, but I think you ought to get a look at that cargo."

Hughes looked up from the code book, and Nevv told him where they were going.

The ship, aft of the control room, was a reminder of their desperate need for speed. The bulkheads had been cut out, leaving little but the structural frame of the ship. And in some places, where heavy internal loads had apparently been removed, only short thick stubs of beams remained.

Nevv, climbing down past the chopped-off beams, wondered uneasily if the ship had been pared a little too closely.

Mannin called back. "There. Take a look at that."

Nevv stopped and looked. Further to the rear, the cargo hung in its separate crates, each crate in its own net of strong ropework, each net held by ropes branching out like the spokes of a wheel to the heavy cables of the cargo web. The cargo web stretched across the axis of the ship from one side to the other, fastened by massive coiled springs to the ship's outermost structural frame. The idea was to cushion the effects of sudden shocks and shifts in acceleration. Nevv, holding to a heavy post, studied the cargo web from overhead. "Looks all right," he said.

Mannin shook his head. "Come closer," he called.

Nevv glanced at his watch, then climbed down ladders past a solitary spaceboat and several stripped-out floors of the ship till he stood beside Mannin on a little inspection platform near the empty center of the web. Then he saw it.

The web was bowed above them, like the arch of a low dome, or a sail stretching ahead in the wind.

Nevv glanced down at the platform. The ship's increasing forward motion held his feet against it. The web *should* be bowed slightly downward, toward the rear of the ship. Instead it arched upward toward the control room and the ship's nose.

"What have we got here?" said Mannin wryly. "Antigravity?"

Nevv shook his head. "I don't know. But I checked this after the first and third breakpoints. It was all right then."

"It isn't now."

Nevv dropped to his knees and opened a trapdoor in the floor of the platform. He climbed down a ladder with Mannin following closely, and walked out a narrow catwalk till it ended at the wall of the ship. He looked up. The massive coiled spring overhead was drawn well open.

Nevv looked at Mannin, and Mannin shrugged helplessly.

"Well," said Nevv, looking back up at the spring, "if we climb up there, maybe we can find out what's wrong." He turned to go up the steel ladder at the end of the catwalk, reached out for the first rung and stopped.

A track of sheared-off stubs ran

up the wall where the ladder had been removed.

Nevv opened his mouth to say something, then cut himself off. He glanced at his watch. With a sensation of relief, he said, "I'm sorry, Phil. I've got to figure out what we're going to do when we hit the next breakpoint. I can't spare any more time for this."

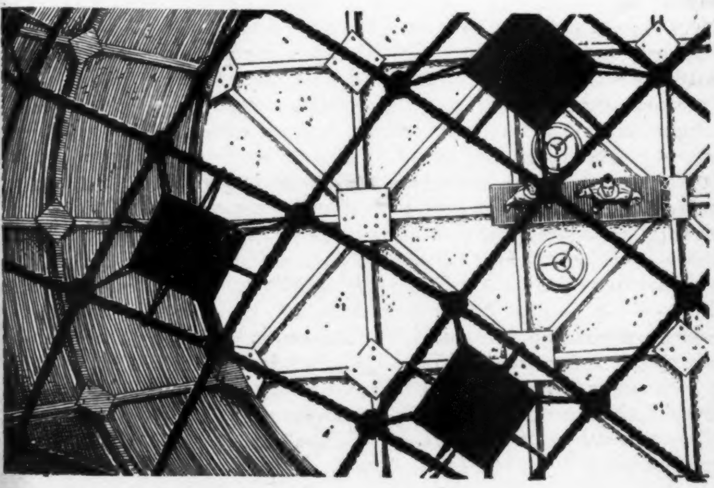
Mannin shook his head. "I'm sorry, Dave. But as astrogator of the ship, I have to ask you to do something about it. It's throwing off my calculations."

Nevv stared up in frustration. "How long has it been like this?"

"This is the first I've seen it like *this*," said Mannin. "The last time I looked at it it was warped too far *down*. I had to go up, take a sightfix, and reset the chronometer guide. Then when the Flats had us under their noses, the ship showed first a slight forward, then a slight backward movement, with *no power applied*. Next, we made the run through normal space in about four-fifths the time it should have taken us."

Nevv took out his handkerchief and passed it across his forehead. He was trying to think, but he was aware that his mind was working as sluggishly as a ship that has gained headway in one direction, and now has to be slowed down, turned around, and started off on a new course. "Can't you take sight fixes and just feed in corrections to allow for this?"

"Yes," said Mannin dryly, "so long as this uncontrolled thrust happens to be applied along the ship's



axis. But what am I supposed to do if it's suddenly applied at right angles? Or . . . say . . . circularly, to spin the ship? I don't have much experience plotting courses for a flying gyroscope."

Nevv stared up at the net for a moment, then looked at Mannin. "We've got to get up there somehow. Then maybe we can figure out what's wrong."

"That suits me," said Mannin. "How?"

"Follow me," growled Nevv.

They turned around and strode back along the catwalk till they reached the ladder to the inspection platform. From here, other catwalks branched out under the web.

Nevv glanced at Mannin. "You don't happen to have a flashlight, do you?"

"No," said Mannin.

"All right," said Nevv. "You take the first catwalk, and I'll take the second. If a ladder is still there at the end of yours, call out."

Mannin squinted down the catwalk, and shook his head in disgust. For the next five minutes, they strode up and down long branching catwalks that invariably ended in blank walls where ladders had been ripped out. They met at the center and peered around at the yet deeper gloom down below. Nevv shook his head, turned and climbed back up the inspection platform ladder with Mannin following close behind.

They climbed back up through several stripped levels, and Nevv made his way cautiously to the spaceboat, rotated it in its cradle, and glanced down. The boat was over a large empty cell in the cargo web. "Go relieve Hughes," said Nevv. "I think we can get down to the web in this thing, but Hughes is the best man to pilot it."

"You want me to stay in the control room?"

"Yes, just in case something else goes wrong."

Mannin climbed out of sight. Nevv leaned out with one hand on the spaceboat, and squinted down at the net. The net sprang down suddenly, and Nevv involuntarily rose on his toes with a feeling of lightness. He grabbed at the spaceboat, felt his weight come back and shoved hard away from the gap between flooring and boat.

The clang of a hatch overhead told of Hughes starting down the ladder.

Nevv told Hughes what he wanted, and the pilot glanced down at the net. "Well," he said, "these boats are built for maneuverability, but with the bulkheads out, we'll pollute the whole atmosphere down here." He glanced around. "It looks to me like they tore out most of the recirculators. This is practically stagnant air. If we pollute it, we'll have to put on spacesuits to work down here."

Nevv nodded thoughtfully and glanced down at the net. He crossed to the spaceboat and found in the emergency kit a big coil of half-inch rope, a flashlight, a claw hammer, and a hatchet. He handed hammer and hatchet to Hughes, who followed him down the ladder.

Nevv crawled out on a beam over the net. The beam crossed directly above one of the catwalks that branched out down under the net. Nevv lowered the rope down through the net, till it reached the catwalk. Then he made a series of hitches around the beam, tested the rope, gripped it with one hand, gripped the beam with the other, slid his feet down, and barely made it from the beam to the rope; then he slid slowly down in stages, the rope wound around one leg and clamped by his feet. When he reached the net, he crawled out onto a crate. He looked up and saw Hughes, pasty-faced, embracing the beam overhead. Nevv studied the crate, then called out, "Tie the hatchet and hammer on the other end of that rope and send them down. Be sure that rope doesn't slip."

Hughes lowered the rope, and Nevv chopped away part of the knotty net holding the crate. The crate itself turned out to be made of stiff splintery wood closely fitted together. Nevv pried at it uselessly with the hammer, then enlarged the gap in the net and chopped a hole in one edge of the crate. He pulled back the boards and shone the flashlight through the hole, stripped back a stiff wrapping, and saw a dark green, crackle-finished cylindrical surface. He pulled away more wrappings and saw on top part of what appeared to be a control panel. A corner of white caught his eye.

Mannin's voice echoed down from above. "I need Hughes up here. We've got to make a course correction."

Nevv twisted around to look up at Hughes.

"Go ahead. I think I've got everything I need."

Hughes inched cautiously back along the beam, and Nevv took hold of the white corner of paper and pulled it out. It was a thick instruction manual, stamped "Deadly Secret—P. M. Corp. Propulsion Unit."

Nevv looked at the manual with considerable awe. "Deadly Secret" was a classification he had never even heard of. He listened as Hughes started up the ladder, then knelt carefully on the crate. He suffered a brief pang of conscience for looking at such exalted material without proper clearance, then opened it up. He flipped through it with one hand, shining the flashlight over a large number of electronic diagrams and technically-worded descriptions. He paused on a page headed "Operating Instructions." He read:

"Due to the unconventional character of the equipment, considerable care and patience may be required before perfectly satisfactory results are obtained. It is advisable to carry out initial practice and testing using only Pilot Sub-Circuit A."

Overhead, a hatch slammed shut. Nevv read on:

"This is highly important.

"Pilot Sub-Circuit A will reproduce perfectly the phenomena to be anticipated from activation of the Main Drive Circuits; but the average continuous energy release will be of the order of 10^{-9} that of the Main Drive Circuits.

"As the underlying nature of the phenomena involved is not perfectly understood, great care must be exercised until such time as the characteristic action produced by Pilot Sub-Circuit A is perfectly responsive and reliable."

Nevv frowned over the last sentence, flipped toward the back of the manual, and suddenly experienced pressure like that of a high-speed elevator starting upward. He jammed the manual in his pocket, grabbed for support, and felt the whole cargo web balloon under him, almost flinging him loose. The crate he clung to shifted around and strained up against the weakened net.

Nevv let go and grabbed his rope.

The crate abruptly yanked away, and whole web snapped downward like the inside of a bowl.

The rope quivered and dropped about a foot, and Nevv suddenly became aware that what he had hold of was the relatively short length Hughes had lowered. Holding his breath, Nevv swung gently out, then back, and managed to grab and swing to the other rope. He looked down. The net suddenly ballooned up again, almost touching his feet. Then the net sprang down and up, and fell part way again so it was flat.

Overhead, a hatch clanged open. Hughes' voice called down, "You O.K. down there, Dave?"

Nevv ran his tongue around the dry inside of his mouth, studied the motionless net for a moment, then slid quickly down the rope. He landed on the catwalk with the feeling that all his life would be anticlimax after this.

Then he remembered what was waiting for him at the next breakpoint.

"Dave!" called Hughes' voice. There was a clattering on the ladder.

Nevv took a deep breath, managed to clear his throat, then called out, "I'm O.K."

Then he felt in his pocket for the manual, and started up the ladder to the control room.

At the next breakpoint, Nevv found himself looking at an even more broad-shouldered individual, with an even wider head and neck, with four red tufts on his yellow sash, a head of grizzled hair, and small crafty eyes that looked at Nevv as if each and every little cell of Nevv's brain was wide-open to view. This officer fixed Nevv with his eyes, said nothing, and looked at Nevv with a perfectly expressionless, waiting face.

Nevv said, "T. S. F. *Prometheus* requests immediate permission to proceed."

The officer on the screen appeared to move his head the tiniest fraction of an inch.

"Thank you, sir," said Nevv courteously.

The officer made no reply.

Nevv put his hand on the firing

switch for nose turret ten. Keeping his eyes focused on the Flat's eyes, he said, "Course green, colonel."

"Yes, sir," said Hughes.

The Flat officer kept his gaze unwaveringly on Nevv's eyes, and Nevv in turn kept his eyes focused hard on the Flat's eyes. It took nineteen minutes to reach the next breakpoint, and in this time neither Nevv nor the Flat blinked once. By the time the Flat vanished from the screen, Nevv felt as if his eyes were coated with dust.

Mannin cleared his throat.

Nevv, massaging his eyelids with his fingertips, turned to see Mannin pull his head out of the astrogator's globe. Mannin's face looked unusually sober and thoughtful.

"Did I miss something?" asked Nevv.

"Nothing worth thinking about," said Mannin.

"What?" said Nevv.

"When we came out, the foreground was loaded with red and orange markers."

"Yes?"

"As we went on, the markers blinked out one-by-one. It looks to me as if they were sending a whole fleet into subspace to backcheck."

Nevv glanced at the chronometer. It showed twelve hours fifty-two minutes till the next breakpoint. He pulled out a message blank and wrote:

"T. S. F. *Prometheus* to T. S. F. V. F. I.: Per Directive Seven rpt Seven B rpt B. Second obstacle passed without incident. However, spacing of obstacles this route appears highly significant. Sending visual records this encounter via sub-sub code eight-bee-eight repeat eight-bee-eight. Phasing out one-zero-six repeat out one-zero six. Request alternatives. Suggest reply spaced silences before phase in.—D. R. Nevv. Colonel, Commanding."

Hughes shoved up the pilot globe, and Nevv handed him the message. "Send it in the old code."

Hughes nodded.

"Oh," said Nevv, "one more thing. How does the ship seem to handle?"

"Fine," said Hughes. "I don't know whether it's because she's stripped-down, or what. But I have the feeling I could pilot her into springing sommersaults if I tried."

"That's nice," said Nevv. He turned to Mannin, who was looking sharply at Hughes, and said, "Let's go below for a minute."

Mannin stepped to the hatch, glanced at the pressure dial by the door, looked back hard at Hughes and went out.

They climbed down past stripped-out levels to the cargo web inspection platform. The web dipped slightly around them.

Mannin and Nevv looked at each other, then glanced up toward the control room. They waited.

Abruptly the web sprang up like a dome.

Nevv started back up the ladder with Mannin right behind him. They went into the control room.

Hughes was in the pilot globe, his hands on the manual controls.

Nevv and Mannin looked at each other, then climbed back down again. They looked up from the inspection platform.

The web was bowed far up overhead.

Nevv took a deep breath. "What will that do to your calculations?"

Mannin said heavily, "Well, it's along the ship's axis. I may have to take sight-readings till I'm blue in the face. But just as long as it's in line with the rest of the thrust." He glanced up toward the control room. "Just so long as the ship doesn't start—springing somersaults."

Nevv glanced at his watch. "Let's see what time you've got. Here, let's set them both the same. O.K."

"Now what?"

"Go up and pry Hughes out of the pilot globe. Ask him if he can try some trial accelerations and decelerations later on. And glance at your watch to see just when he comes out of the globe."

Mannin nodded and started back up the ladder.

Nevv looked soberly up at the ballooning net, pulled up the trapdoor and climbed down onto the catwalk. He strode to the end of the catwalk, and looked up at the massive spring. Its heavy coils were pulled considerably farther apart than before. Nevv walked back and started up the ladder. Part way to the platform, the net suddenly dropped back and hung with a shallow dip. At the same moment, Nevv felt lighter.

Nevv glanced at his watch.

The hatch clanged far above. There was a sound of shoes against metal, then a pause, more sounds, and another, lighter, sound of the hatch.

The cargo web sprang upward. Nevv clenched his teeth, braced himself as his weight increased. He glanced again at his watch. He fished a pencil from his pocket, located a scrap of paper in his wallet, and marked down the times when the web had moved.

Overhead, the hatch shut. There was a faint scuff and rattle of descending feet. Mannin came down with a pencil stuck over one ear, and handed Nevv a message blank. "There's the time he got out from under the globe. I asked him if he could do some trial accelerations and decelerations. He said, 'Sure.' I started down, then sneaked back up and watched him settle the globe in place. That's the second figure."

Nevv compared these figures with his own. Within a margin of a few seconds, they coincided.

Nevv glanced at Mannin. "Can you work out a test series that won't throw us too much off schedule? One you can correct for easily?"

"I think so."

"Don't make it too drastic. I want to watch it from here, and I don't want to be thrown out through the hull."

Mannin nodded, looked hard at the net, and started up the ladder.

"Wait a minute," said Nevv suddenly. "Help me get that rope first."

The two of them retrieved the rope Nevv had climbed down on to the cargo net, then Mannin went on up to the control room. Nevv roped himself flat on his back on the inspection platform. He lay still, warily watching the cargo.

The web began to inch yet higher. Nevv felt himself pressed harder against the floor of the platform. The heavy cables of the cargo web creaked.

Abruptly the web dropped down. The platform fell away from Nevv's back and the ropes bit into his chest, midsection and thighs.

The web sprang up again. Nevv was pressed hard against the floor.

Nevv lay still and rose up, watching the web alternately spring high above, then fall far out of sight. Eventually the hatch clanged, and Mannin came down the ladder. He helped Nevv up. "Did you find out anything?"

"Just that we've got the first pilot in history to fly the ship by means of the cargo. How did the tests work out?"

"Well, the ship's initial acceleration was about thirty per cent above normal. The deceleration was fifty-one per cent above normal the first try, and inched up to about fifty-eight per cent above the last try."

Nevv frowned, glanced at the net, and started up the ladder. They entered the control room, shut the hatch, and looked at Hughes, his head in the pilot globe. Nevv got out the "Deadly Secret—P. M. Corp. Propulsion Unit" instruction manual. Nevv and Mannin huddled over it intently.

They went through it once rapidly, skimming quickly over bristling tracts of terminology, and pausing to study circuit diagrams and detailed drawings of the unit's exterior. Then they went back over it again and forced their way through the tougher parts like men chopping thick undergrowth with machetes. At the end, they looked at each other blankly.

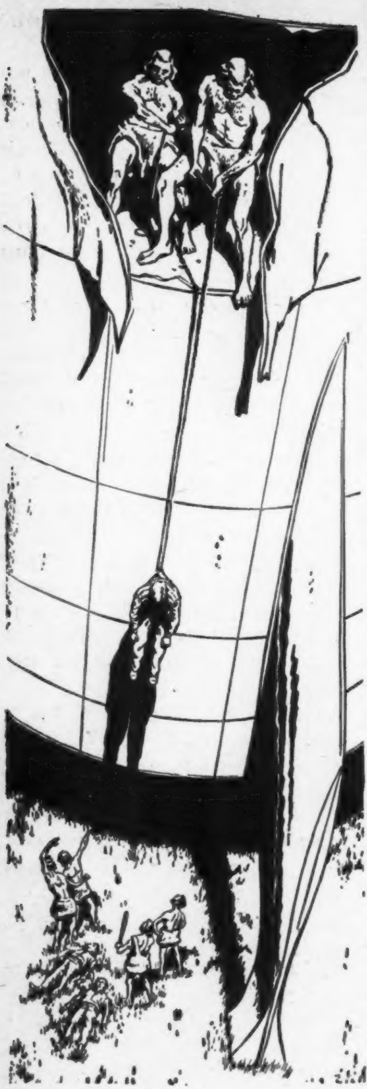
"Well," said Nevv, "let's try it again." His mind swum with sentences like: "In the following Tentative Operating Instructions, a number at the beginning of a paragraph refers to a dashed arrow in figure III b at the top of page six herein, except where Experimental Models X-2a or X-2b are under consideration, in which case the aforesaid number refers to a dotted arrow in figure IVa at the bottom of page one of Supplemental Leaf 6a, unless otherwise stipulated elsewhere."

Mannin suddenly got up and said, "I've got to take a sight fix. You see what you can make of it."

Nevv looked up to see Mannin start across the room with an expression of relief. Nevv looked at the manual with exasperation, then began leafing through it slowly. When Mannin came back, Nevv was reading one part over and over.

"Find anything?" said Mannin hopefully.

"I don't know," said Nevv. "Look



at this." Mannin bent beside him and they read:

"The controls of the Propulsion Unit are unusually simple, and, after sufficient skill has been acquired, may often be operated with a minimally light touch. It is highly important for the unpracticed operator to have clearly in mind a precise mental image of the action the Propulsion Unit is intended to perform. It is at first necessary that this correct mental picture be thoroughly understood and borne in mind to obtain the maximal level of performance consistent with the operator's skill and personal qualifications."

"Hm-m-m," said Mannin. He glanced over at Hughes with his head in the pilot globe. He looked down again at the manual. "'Minimally light touch,'" he quoted.

Nevv followed Mannin's gaze to Hughes, then thought of the cargo web alternately billowing up and sagging down as Hughes' mind concentrated on accelerating or decelerating the ship. "It's an uncanny idea," he said.

"It sure is." said Mannin.

"Still," said Nevv, certain possibilities beginning to occur to him, "if it *does* work that way—"

"Yeah," said Mannin, nodding agreement.

"Pry Hughes loose from that globe," said Nevv, and looked back at the manual. Again he read the paragraph.

Hughes came over and grinned. "What a ship. We should strip them all down."

Nevv and Mannin explained to him about the cargo, then Nevv said, "It seems to me that by the time we come out the next breakpoint, the Flats will have spent thousands of man-hours convincing themselves we've fooled them. They'll be in no mood to be bluffed all over again. What we need is something completely unexpected—"

Hughes, perspiring uneasily, said, "Wait a minute, Dave. Are you trying to tell me the ship goes even faster when I think it will go faster, and slows down more when I think it will slow down, *just because I think it?"*

"Well, in effect, with this cargo—"

"What happens if I can't convince myself? I mean, this whole idea is pretty fantastic, but just suppose—"

Nevv glanced up at the chronometer and felt a fine perspiration forming on his brow. He leaned back and forced a bleak smile.

Mannin said earnestly to Hughes, "You just did it. It should be no trouble at all to do it again." He added, "If we're going to get an edge on the Flats, you've *got* to do it again."

"Yeah," said Hughes, "I did it unconsciously. How do I know—"

"Look," said Mannin determinedly. "We've *got* to get the stuff through to the Colony. To say nothing of our own skins."

Nevv forcibly relaxed his suddenly tensed muscles and tried to ease his mind away from the problem for a moment.

Hughes said, "On *faith,* you want me to do it. O.K., I'll try—"

Nevv thought that now that it was too late he could see it plainly enough from Hughes' point of view. Show a man a twenty-foot hurdle over a pit of snakes and say to him, "If you believe, our device here will get you across safely. But if you *don't* believe—well. . . . But, on the other hand, you must get across. You've *got* to, because—"

Hughes was starting to turn away. Nevv could see Mannin's tenseness, and a sort of angry resentment on Hughes' part.

Nevv said, "Wait a minute. I think we've got all the parts of the puzzle, but we're trying to jam a couple parts together that won't fit."

Hughes said, "I'll fly . . . or try to fly . . . any ship made that runs by controls. But you stick me in an empty cubicle and tell me to *think* I'm flying, and I don't promise you anything at all."

Mannin said, "We saw it. You've done it already! You can't say you can't do what you have done."

Nevv took a deep breath. "Well," he said quickly, "what we've got to remember, of course, is that what we're talking about is only the supplemental part of the thrust. The main drive of the ship, of course, supplies most of the thrust, and that isn't affected at all by what we're talking about."

"No?" said Hughes. "Suppose I should try for maximum thrust from the ship, and then it should occur to me to think about going slower? Then what?"

"Holy—" began Mannin, his voice grating.

Nevv could now clearly feel the perspiration on his forehead. He glanced unhappily at the chronometer, thought a fervent prayer, then launched back into the conversation. "Splendid! That would be wonderful! You'd cut the forward motion while the radiation from the drive units remained constant. The idea is to throw off the Flat gunnery computers. Practically any unpredictable action will do."

Hughes looked a little dazed. "Wait a minute—"

Mannin started to say something, then cut himself off.

"Now," said Nevv firmly, "the control factor you have to use at first is precise visualization—"

"How could that affect the cargo?" Hughes demanded.

Nevv looked surprised. "Through the resonant q-wave receiver in the unit's control circuit, of course. Didn't we explain that?"

"No, you didn't. What in space is a resonant q-wave receiver? And who thought that up?"

"It's all here," said Nevv, tossing across the manual. "You read that, and you'll know as much about it as we do."

Hughes scowled and picked up the manual. He started to read it, then flipped back through it slowly. His face began to relax. "Well," he said, handing the manual back to Nevv, "that looks scientific enough. What's all this business about doing it on faith?"

Mannin made a choking sound, and Nevv said quickly, "If we said that, we just expressed it badly. The correct procedure is the visualization, with the regenerative action of the pilot globe coupling the q-output to the q-wave receivers in the Propulsion Unit control circuit. You look at diagram VIII b, there, I think it is . . . about the middle of the book."

Hughes reached out, then yanked his hand back. "What do I want all that stuff for? I'm a pilot, not an electronics technician. What I want to know is, what do I *do?*"

"Well, you visualize the action desired. The q-waves, transmitted by the—"

"Hold on," said Hughes irritably. "I don't want to go through all that. All *I* do is to visualize it, is that right?"

"That's it," said Nevv.

"Then," said Hughes tentatively, "the q-radiations activate the control circuit. But I don't have to worry about that. All *I* have to do is visualize it. Correct?"

"Absolutely," said Nevv.

"O.K." Hughes looked thoughtful. "Listen, what if I visualize a sudden rotary motion?"

Nevv felt that he had to say something. "My understanding," he said, "is that the Propulsion Unit is perfectly multi-directional. He was about to add some vague qualification when Mannin cut in hotly.

"Listen," said Mannin, "I can plot a course for a spaceship, but

I'm not checked out on spinning tops."

"Never mind about that," said Hughes. "You just wait till we come out in normal space, and lay down your course as usual. Leave the rest to me." He started back across the control room, then stopped. "I'm going to get in a little practice, then get some rest. You guys scared me for a minute. I thought I was supposed to work some kind of hoodoo."

"It's all right there in the manual," said Nevv, feeling a little weak.

Mannin, Nevv, and Hughes, all got at least a little fitful sleep before the next breakpoint arrived. When it did come, and Nevv's eyes adjusted to the blaze of white pinpoints against deep black, there was a space of perhaps two seconds when Nevv thought they might possibly have no trouble, this time, at least.

Then the glaring markers began to spring into place. Hughes' voice began to drone. "Near right background high, near right background low, near right foreground high—three of them, near right foreground low—"

A single green line hung in front of Nevv's eyes. Mannin said, "Just one route this time."

". . . Far left foreground high—two of them, far left foreground low, near left foreground high—one, two, three, four, five—" His voice cut off abruptly. "The place is full of them."

The short purple line marking the backtrack appeared before Nevv. He pushed up the command globe. Before him, the screen flared and lit to show a huge, broad-shouldered officer whose yellow sash bore tufts of red from one end to the other. In the clusters at his shoulders, each gold spike bore at its tip its own cluster of long shiny gold needles. Nevv's eyes rose from the tufted sash to the immense shoulders, broad neck and wide head. This officer was white-haired, with his eyes fixed thoughtfully on Nevv's, and something approaching a compassionate expression on his face. He shook his head ever so slightly as he watched Nevv. "Very clever, my boy," he said, "but of course you were bound to be stopped sooner or later. The odds were far too great. Don't move your ship now."

Nevv reached out for the firing console.

The Flat's pitying expression was having a worse effect on his morale than anything before, and he had a little trouble keeping his face expressionless.

The Flat said quietly. "Don't give us the Vengeance Fleet business, now. We know better."

Hughes hissed, "Shall I let him have it?"

Nevv said mechanically, "Sir, I am aware now that for some reason you doubt the word of a Terran officer. I am astonished."

The Flat smiled. "No doubt your 'honor' is touched. I must tell you, colonel, that our sense of boggleglobble is similarly affected by your whole story. Moreover, all this chasing around has had a bad effect on our budget."

"I am very sorry, sir," said Nevv, grimly holding to his story. "The apparent lack of belief of your subordinate officers has been conveyed to my superiors."

". . . Who are still in subspace?"

"I cannot disclose their whereabouts—"

"*We* can't find them anywhere."

"Sir, secrecy was one of the prime considerations when this force was readied for action."

"It must have been. How is it that *you* turn up again every time we look around?"

Nevv had a sensation of blood rushing to his head.

Hughes' voice said, *"Ahh."*

Nevv said quickly, "Sir, further secrecy on my part would be pointless. The mission of *Prometheus* has now become, first, to determine by your actions whether any collusion exists between your people and the miserable vermin who have insulted our flag." The whole foreground was acquiring a pinkish tinge. The Flat's huge form began blinking on-and-off on the screen. "And, second," said Nevv, "to warn you by primarily defensive maneuvers of exactly the sort of unknown factors you are now up against."

The whole ship sprang forward, ramming Nevv far back in the acceleration couch and choking the breath out of him. There was a high, squeaking screech, and his insides seemed to twist sidewise and up. A nauseous sense of being wrenched two ways at once gripped him, and he was swallowed in a rush of blackness. His last dwindling sensations were of a heavy crash and an abrupt silence.

Nevv came to with the impression that he was strapped to the arm of a big clock, and the arm was swinging around and around. He heard Hughes say, "This control room is just a trifle more off-center than I thought it was."

Mannin, speaking in gasps like an exhausted runner, said, "I've always had . . . good feeling towards you, Hughes . . . but just exactly what . . . did you do just then?"

"Spun the ship like a gyro," said Hughes proudly, "jammed on full forward acceleration, then gave her everything I had to jerk the tail sidewise and around in a new direction. She really jumped, and then I improvised a little." He chortled. "They never came near us."

Nevv opened his eyes painfully. His head was throbbing and he felt sick and weak. His mind went in feeble circles grappling with Hughes' maneuver: If the ship were spinning clockwise, and its long axis was suddenly swung in the arc of a circle— Well, the ship might be considered a uniform hollow cylinder— Wait, what about the armor belt? Consider the simplified case of a short cylinder—

Suddenly Nevv came wide awake. He spoke and heard only a hoarse whisper. He swallowed hard, took a deep breath, and managed to say, "Where are we?"

"Subspace," said Hughes triumphantly. "I whipped her back on course and slammed her through right at the breakpoint."

Mannin said, "Spinning?"

"Yes, pretty hard," said Hughes. "Why?"

"It seems to me"—Mannin paused, and Nevv heard him take a breath—"the spin would induce an electromagnetic field— What that would do in subspace, I don't know."

"Well," said Hughes, "anyway, we're here. *Boy* what a ship!"

"Sure," said Mannin feebly. "But where is here?"

Nevv unbuckled himself from the acceleration couch and looked dizzily around. "Phil," he said, "if you can manage it, take a sight fix, will you?" He turned to Hughes. "I haven't figured out what you did yet, but I'm glad we're still alive." He remembered hearing the crash, and wondered if anything had broken loose. "How's she handling?" he asked.

"Beautiful," said Hughes.

Nevv decided he had better take a look anyway, and walked carefully to the hatch. He hauled back on it and nothing happened. Nevv thought that he must be weaker than he had imagined and gave a hard tug. The hatch remained as solid as a section of wall.

Mannin said sourly, "To be perfectly honest, I don't see anything here I can identify."

Nevv put one foot on the wall, both hands on the hatch handle, and heaved back with all his strength. His arms felt like they were pulling loose at the shoulder joints, but aside from that, nothing moved.

The communications receiver went *ping,* and Hughes said soberly, "I'll get it."

Mannin said, "If we stop right where we are and cast around, I think there's about a twenty per cent chance we can find out where we are. It may take us a week to do it."

Nevv gave a little yank on the hatch, then stepped back. His gaze chanced to fall on the air pressure gauge by the door. The black pointer of the pressure gauge was resting on its pin, its point at the zero mark.

Hughes said, "This message is in the old code."

Nevv growled, "Unscramble it." He whacked the pressure gauge with his hand. The pointer didn't move. He turned around, walked over and picked up the microphone. "Men," he said. No answering boom came from the direction of the crew's quarters. Nevv hit the "Prepare" bar on the firing console, felt a faint vibration in the deck underfoot, but heard none of the jarring clatter of the Battle Station's gong. Plainly, there was no air back there to conduct the sound. He walked back to the hatch and pushed the emergency air-lock button. A little warning light lit up red, there was a hiss, and Nevv waited for the light to turn green. The hiss ceased, but the light remained red.

Mannin said, "That just could be Sclythes VI over there, and if so, it will take us at least an hour-and-a-half to get back on course."

Hughes said in an unhappy voice, "I've got the message decoded."

"Let's hear it," said Nevv grimly.

"Supreme High Command to All Ships in Volume Twelve," read Hughes, "Relay the following: To Terran ship T. S. F. Dreadnought *Prometheus*: Kindly return to pick up upper segment your fuel feed mechanism, one Mark XII oversize coil spring, and large quantity unnamed small parts and pieces recovered by our salvage detectors.—Cordially, Sasram Vannaf, Supreme High Admiral, Commanding."

Mannin said, "On closer observation, that couldn't possibly be Sclythes VI."

Hughes started for the hatch. "If that really *was* the upper segment of the feed mechanism, we're in an awful mess."

Mannin pulled his head out of the astrogator's globe, snapped a little spool in the viewer, and said, "If it doesn't turn out to be Epinax or Castris, we might as well start saying the last rites now." After a moment, he added, "It isn't Castris."

Hughes tugged at the door.

"No use," said Nevv, "the air out there is gone. We've got atmospheric pressure at about one ton to the square foot on this side holding it shut."

Hughes stepped back, looked at the air-pressure gauge, whacked it a couple of times with his hand, then shook his head wearily.

Nevv said, "Send this in the old code. 'T. S. F. *Prometheus* to T. S. F. V. F. I.: Your assumption correct. Will comply.—D. R. Nevv, Colonel, Commanding.' "

Hughes nodded.

Mannin said, "Well, maybe we'll make it yet. That's Epinax, and it's going to cost us a five-hour delay."

In a low voice, Hughes said, "If we've lost the upper segment of the fuel feed, we can't afford *any* delay. The only fuel we've got left in that feed is on the lower parts of the mechanism."

Nevv said, "What about the reserve?"

"We'd have to lock it in place manually. And I'm not sure the reserve fuel isn't one of the things they stripped out to save weight."

Nevv looked at the emergency air lock with a sudden unpleasant thought. "Did anyone happen to notice if we've still got the air lock here?"

Mannin said, "We've got the base and the hinges. I noticed that the last time I came in. The lock door itself is stripped out."

Nevv felt as if he had been hit in the pit of the stomach.

The communications receiver went *ping*.

Hughes trudged over to it. After a moment, he said, "This is in the new code."

"Decode it," said Nevv.

Mannin said, "Did somebody say something about the air being gone from the aft section?"

"Yes," said Nevv. "We apparently lost the upper segment of the fuel feed right through the outer wall the last time we got away from the Flats. With all the bulkheads stripped out, the air just went out through the hole."

"Oh . . . Oh," said Mannin. "Well, there's at least one spacesuit in the emergency locker there."

"That's good," said Nevv, "but the point is, this hatch opens *in*. There's no air pressure on the other side. On this side, there's normal pressure of about 14.6 pounds to the square inch. That's around a ton to the square foot. You'd need a man with an iron arm to haul that hatch open. Once it was open, the air in here would blow out into the aft section and diffuse into outer space. If we weren't in spacesuits, that would be the end of us. If we were in spacesuits, the air supply wouldn't last forever, to say nothing of trying to run the ship from the inside of one of those things."

Mannin exhaled sharply, turned around, opened a square cabinet and pulled out a thick volume.

Hughes said wearily, "I've got the message, Dave."

"Let's hear it."

"'Blue Base Colony Six rpt Six to T. S. F. *Prometheus*: Under heavy attack. Need help badly. Your messages intercepted here. At first dismissed as Flat hoax, but that not comprehensible. If you have force available as indicated, urgently request your aid. Please advise at once. Use latest code delivered by courier. Red Base is captured and old code with it.—T. B. Smith, Lieut. col., Commanding.'" Hughes looked up. "That was all in the new code except the sentence, 'Use latest code delivered by courier.' That was in clear."

Nevv nodded slowly, and turned to Mannin. "Did you notice about the reserve fuel supply?"

Mannin looked up with one finger holding his place in the book, "I think it was there, Dave. When I was helping you get the rope hauled up, I noticed something bulky overhead in about the right place for it."

Nevv said to Hughes, "How long will the normal fuel supply last, exclusive of that in the upper segment?"

Hughes glanced at the chronometer. "It might just last to the next breakpoint— If we don't have to detour."

Mannin said, "We've *got* to detour."

"Is that," said Hughes, "actually going to take us five hours?"

"Yes, it is."

"We can't do it," said Hughes. "We just don't have enough fuel. Unless the Flat was bluffing."

"We can't assume he was bluffing," said Nevv. "I don't see how he could have guessed that the control room air lock had the door stripped off. And that's all that keeps us from just going back and checking." Nevv frowned. "Is there any way to get the reserve fuel to the feed mechanism?"

"Only by taking it out and locking it on manually. We can't do that without first getting out of the control room."

"Well—" Nevv turned to Mannin. "Is there an Earth-type planet listed that we can reach from here?"

"Two," said Mannin. "If we break out of subspace in forty minutes, we can reach Blackwall III, an Earth-type planet with an aggressive alien mechanized culture. If we break out in a little over two hours, we can reach an unnamed Earth-type planet with a nomadic humanoid culture. And that's all there is, unless we want to wait half-a-day more."

"What's the humanoid planet like?"

"It was surveyed about a hundred and sixty years ago. Quite a load of exotic diseases, but I think we've got the shots for them in the emergency kit. The language of the most advanced race is on file in the General Hypnoculture Index. The planet's code is 'D'—suitable for emergency landing for minor repairs. It says here the local food is edible; but then a man can starve while he figures out whether the bark, bud, root, leaf, or fruit is what he's supposed to eat."

"I hope," said Nevv, "we don't stay there that long. All we want is to raise the air pressure in the aft part of the ship, get this air lock open, and put the reserve fuel in the feed mechanism."

"Well," said Mannin, "it looks like we ought to be able to do that, all right."

"Good, then plot a course to it." Nevv turned to Hughes. "Is there anything you know of that could delay us once we get *that* done?"

"No," said Hughes.

"All right." Nevv took a message blank and wrote:

"T. S. F. *Prometheus* to Blue Base Colony Six rpt Six: Am instructed to inform you Reserve Killer Group One rpt One, Reserve Killer Group Two rpt Two, Reserve Killer Group Three rpt Three now being detached to destroy enemy forces operating against you. Projected time of arrival: eighty-four hours following code-date this message. You are instructed hold out with all possible grip and tenacity. Vital situation hinges on you.—D. R. Nevv, Colonel, Commanding."

Hughes took the message, looked at it, swallowed, looked at Nevv and said, "What code?"

"The new code."

"Yes, sir." Hughes bent over the code book.

Mannin said, "I've got the course plotted. It'll take us, one hour and fifty-seven minutes to get to breakpoint. Landing on the planet should be a perfectly routine matter. That leaves me personally nothing to do for over two hours. Just as a safety precaution, I wonder if I should go under hypnoculture and learn the local language."

"We'd both better," said Nevv.

Hughes looked up. "Shall I?"

"If you think you can trust the automatics."

Mannin said, "What about shots? We're bound to be exposed, and a good high fever could put the lot of us out of action for a week."

"We'll have to take the shots in turn," said Nevv. "I'll take them first so we can see what their effect is."

Mannin nodded, grinned suddenly, and hauled out the bulky medical emergency kit. As Nevv looked on, Mannin opened the kit, took out a thing like a needle-snouted machine pistol, went over and got the manual, glanced alternately at it and the kit, and began clipping small vials into a magazine that slid into the grip of the gun. As if to himself, he murmured, "Let's see, paratyphoid outvar, gamma six, contagious prothrombinopinex, graymold fever, toxic enteromycosis, chronic infectious hypoxemia, stumprot, nicterine hypsophobis, osnithosis outvar. beta three—" He stood up, holding the gun. In a businesslike manner, he said, "All right, remove your shirt." He gave a routine-looking smile, "This won't hurt a bit." He swabbed Nevv's arm, and swung up the bulky, needle-tipped pistol.

Nevv felt his arm go numb. He turned so that his eyes were straight ahead. "This is no time to start unfolding your latent talents," he said grimly.

"Stand still there," said Mannin. There was a *thug* sound, then another, and another, *thug, thug, thug*.

Nevv felt a wave of heat, a sudden chill, and an overpowering dizziness. He felt hands steady him, he tried to catch his balance, then everything went black.

Nevv gradually became aware of a lazy swirling dizziness, and a ringing in his ears. He drifted a little further awake, and realized that his mouth felt dry and his head felt hot. He tried to sit up, and felt so faint that he had to lie down again. He lay still for a long time. Eventually, he opened his eyes and looked up. It took him a moment to focus his eyes. Then, very carefully, he swung his feet to the floor and stood up.

Mannin and Hughes were both stretched out unconscious. The gun lay on the floor at Hughes' side.

Nevv stepped to the hatch and glanced at the pressure dial. It read "14.2." The pressure in the aft part of the ship was almost normal. Nevv walked back across the control room, and pulled down the command globe. A scene appeared of brown grassland, low distant hills, and small clumps of trees and brush. Far away, what looked like a wispy column of smoke drifted skyward.

Nevv pushed up the globe and glanced around the control room. The thought came to him that he could switch the reserve fuel to the fuel feed mechanism while Hughes and Mannin were still unconscious. But he wasn't sure just how the immunization injections would affect either of them, and he still felt weak himself. He decided to stay, get out the hypnoculture records and learn the local language.

Mannin came to before Hughes, and sat up with his brow knotted, his eyes tightly shut, and his lips drawn away from his teeth. He made a gagging sound, and Nevv said, "Water?"

"No, I'll be all right." Mannin opened his eyes, gradually uncrossed them, put a hand to his head and carefully got up. "How's Hughes?"

"Still out."

"I must have passed out on him. He gave me the shots, and I was going to give them to him. Did you see we'd landed?"

"Yeah. I've been learning the language. Not that we should ever need it."

Hughes groaned. Nevv turned around, and saw Hughes open his eyes and carefully sit up. "O.K.?" asked Nevv.

"Yeah, I think so," said Hughes. "Boy, I dreamt the Flats had me."

Mannin said, "Let's hope that doesn't happen."

Nevv walked to the hatch and back. He felt reasonably strong. "Have we tested the air?"

"The analysis equipment," said Hughes disgustedly, "was apparently stripped out."

Nevv turned to Mannin. "How was it a hundred and sixty years ago when the survey was made?"

"Fine. A trifle high on oxygen, but that's no problem." Mannin got to his feet, and walked carefully around the room, and Hughes did slow cautious knee-bends and gentle loosening-up exercises.

Nevv went to the hatch, and checked the pressure gauge. He pulled back on the hatch. The hatch opened, and Nevv felt as if a miracle had happened. He started down the ladder, with the others following. He paused at the level just above the cargo net and looked up. There, well out of reach and heavily braced in place, was a bulky, solid-looking case marked in red:

CAUTION!
EMERGENCY
FUEL

There might once have been some natural way to approach this case, but none was visible now.

Mannin growled, "A ship like this needs a crew of man-sized spiders to run it properly."

Nevv could think of nothing to say at all, and Hughes let out a snort of disgust. "Let's check the feed mechanism first."

They climbed down the ladder, paused at the inspection platform to look at the cargo web, sagging slightly out-of-shape, then climbed on down to the catwalk. In the wall to the side, above them, was torn a sizable hole, with the blue of the sky outside showing through.

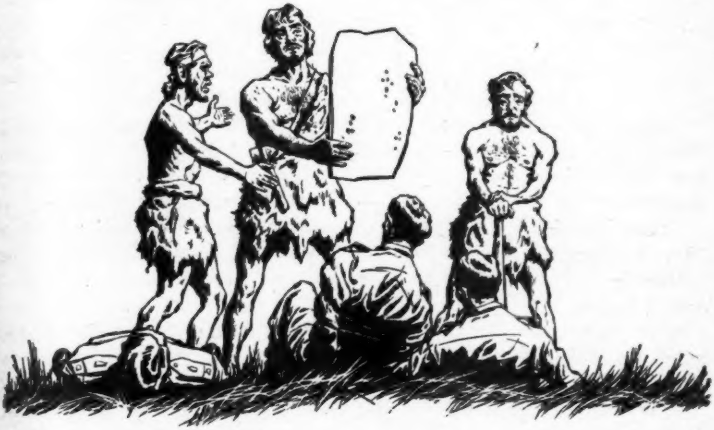
"That," said Mannin, "looks like where the spring went through."

Nevv leaned over the side of the walk and stared into the gloom below. To one side was a very large, jagged-edged hole through which light shone onto the floor below. For a fleeting instant, it looked to Nevv as if the shape of the hole, and the light on the floor, shifted and changed. He blinked his eyes, and watched. Through the hole, he could see the brown of the grassland outside.

Hughes said, "There's a trapdoor in the floor here somewhere."

"Sure," said Mannin. "But is there still a ladder?"

There was a rusty creaking as the trapdoor came open, "Don't feel any— Wait. Yes, here it is."



"Be careful," said Mannin. "You can't tell. They may have sawed it off halfway down to save weight."

Nevv said, "Hold on a minute. Do we have a flashlight? Shut that trapdoor a minute."

Mannin said, "What's wrong?"

"I don't know if anything's wrong. But if we can get a strong flashlight, we can look down there first without having to go down. What happened to the one I had? Did I bring it up to the control room?"

"I don't know," said Mannin. "I'm surprised there was a flashlight on the ship."

Hughes said, "I don't mind going down, Dave. We might just as well find out since we're here."

Nevv's eyes were gradually becoming accustomed to the dark. It seemed to him he saw a faint movement on the floor at Hughes' feet. Nevv bent forward.

A vague shape, light and fast, swung up at Nevv's side. The catwalk swayed underfoot and Nevv's neck was clamped in a grip like a vise.

"Look out!" yelled Hughes.

There was a solid *crunch,* and a sudden silence.

A low, almost whispering voice spoke in Nevv's ear. "Glawarmish, *Vilna.*" The words resolved themselves into, "Welcome, *Friend*." "Friend," was spoken in a cold, ironical tone.

From below came a soft voice. "Destra vilna sosso hottig." Nevv heard it partly as a foreign tongue, and partly as it's meaning: "Bring the dear friends down here."

The next time the voice spoke from below, Nevv was scarcely aware at all of the unfamiliar words. This time the voice said, "Two of you sneak up there, and see if there are any more of them at the top."

There was a very faint sound on the ladder, going rapidly up. A second followed.

Nevv considered the chances if he were to bring his heel down hard on the instep of whoever had him from behind. There were already two up near the control room. But if he could get the spaceboat—

While Nevv was making his decision, a rope tightened around his hands, a cloth dropped over his head and yanked into his mouth, and a rope jammed hard around his ankles. He was upended and lowered head first over the catwalk.

He wanted to shout to Mannin or Hughes but he discovered that the gag so jammed his jaw and tongue, that it was impossible to make a meaningful sound. Then he felt the noose at his ankles starting to slip, and all his attention was drawn to bending his feet as sharply as possible to keep the rope from slipping loose and dropping him on his head.

A voice called down from far above. "No more of them up here."

"Good. Come on down, then."

Strong hands gripped Nevv by the shoulders, and a deep voice behind him said, "What did you have to lower him by the feet for? Suppose the rope let go?"

A hissing voice answered from above, "I would gladly have put the noose around the other end of him, but that isn't allowed yet."

A third voice spoke out of the gloom. "Enough of that. Put them all outside in the sun, where we can get a look at them."

Nevv was bundled out through the hole in the side of the ship, and lowered by a rope passed under his arms and across his chest. He was dropped on the brownish grass, and Hughes and Mannin were dumped beside him.

"Go get the Inspector," said someone, and Nevv involuntarily twisted around. The word "Inspector," had been spoken in Terran.

Now he was in daylight, Nevv could see his captors. They were muscular hairy sunburnt men, with furry skins tied about their waists. They had shrewd eyes and an erect bearing, and were looking from the ship to their prisoners thoughtfully.

Beside Nevv, Mannin groaned miserably and twisted around.

One of the fur-clad men shifted his short, thick club. "Lie still, you. You will get what you deserve."

Someone said, "Here comes the Inspector."

Nevv turned his head and saw a man with a white band at his forehead striding briskly forward, followed by two men carrying a box with long handles. "Where are the suspects?" asked the Inspector. "Suspects" was in Terran.

"Right over here."

The Inspector came over, folded his arms on his chest and studied Nevv, Mannin and Hughes. The Inspector frowned. "Roll them on their sides a minute. Hm-m-m. Stand them up. I see. Well— Turn them sideways. All right, now tilt them forward. Hm-m-m." The Inspector turned to the men carrying the box. "Get out the front view."

The two men set down the box, opened it up, and removed a large piece of thin grayish stone. Handling it carefully by the edges, they held it up. Drawn in white on the stone was an excellent likeness of a man with remarkably broad shoulders, a broad head and a broader neck, with small crafty eyes, bushy brows, and a head of bristly hair that ran down his neck on either side and vanished under his collar.

The Inspector looked from this drawing to Nevv, and back at the drawing again. A crowd gathered around, and followed the Inspector's example. The Inspector went over to the box and lifted out other thin slabs of stone, glancing first at them and then at Nevv, Hughes, and Mannin. Scowling, he disappeared into the crowd, and came out with a gnarled, white-haired man. "You took care of one when he was sick," said the Inspector. "See if these are the same."

The white-haired man put his ear against Nevv's chest, first on one side, then on the other. He put his ear against Nevv's midsection. He pushed Nevv's head over on one side and ran his hand down Nevv's neck. He stepped around and looked at Nevv from several angles. He did the same for Hughes and Mannin, then shook his head decisively. "These are different."

A little murmur went up. The Inspector said, "Take the gags out of their mouths." He looked at Nevv and asked, "Where do you come from?"

"Up there," said Nevv, glancing at the sky.

The Inspector scowled, and nodded his head at the drawing. "These others said they came from up there, too. Are you, perhaps, related to them?"

Nevv hesitated an instant, then said firmly, "We are fighting with them."

The Inspector's eyes glinted. "Who's winning?"

"At the moment, they are. If we can fix something that went wrong with our"—he hesitated, groping for a word—"wagon there, we should be able to win."

The Inspector glanced at the ship. He gaze rested on the hole torn in one side. He turned around and snapped orders. "Go get Netsil and all his scientists." The word "scientists" was in Terran. "Go tell the king, and ask for two hundred sturdy laborers. Let them rush here like the wind. Send a signal to the missile-testing ground"—this was in Terran —"and bring the Big Arm in case the others should come down before we're ready."

Men darted through the crowd, and from a distance there were shrill whistles. "Here, Boy! Come, Runner!"

An instant later, the ground trembled underfoot. A long brown blur shot into Nevv's field of view, swung around in a haze of dust and flying bits of turf, and streaked for the horizon.

The Inspector raised his arm and said solemnly, "The enemy of our enemy is our friend. Let the ropes holding our friends be cut and burnt in the fire. Let all men deal with our friends fairly."

A murmur of assent went up. The ropes were undone, a short piece was cut off of each and tossed on the ground. Someone dropped some sticks and began to arrange them. The Inspector came over and said, "I knew you were honest the instant I saw you, but we can't take chances." He glanced at the broad-chested drawing. "Those vermin came down in their sky-wagon, got sick, and our cousins to the west cared for them like their own. When they got well, our cousins shared the great wonders of our science with them, and tried to convert them to our way of living. But they stuck to their . . . no offense . . . wizardry, and when they left, they carried off with them four of our most beautiful women, a newly-made suit of silver temple armor, two sacred gold incense burners, and sixteen haunches of fresh-cured swamp-ox."

Nevv shook his head. "Our experience with them has been much the same."

The Inspector looked up at the sky. "We'd help you fight them, but we don't have any way to get up there."

"Don't worry," said Nevv fervently, "you just let us get back to work and we'll take care of them."

Mannin said, "We'll shake them till their teeth rattle in their skulls."

The Inspector's face suffused with pleasure. He let out a bellow, and men came running. "Help our friends back into their wagon. If they want anything, get it. If you can't get it, tell me right away."

Nevv, Mannin, and Hughes were hoisted back up through the hole in the ship. They clambered in and stared at each other in the murky interior. Hughes let out a half-hysterical laugh. "Well," he said, "what did we come down here for, anyway?"

They went to look at the fuel feed mechanism.

The upper segment of the mechanism turned out to be completely torn away, and Nevv and Mannin climbed up for another look at the reserve fuel supply case. This case squatted with safelike massiveness well out of their reach and was solidly fixed in place. With the help of their new friends, Nevv and Mannin were hoisted and swung over to it, and by stages managed to get the reserve fuel down to Hughes, who at last locked it onto the feed mechanism.

Nevv again climbed down onto the cargo net, and very carefully examined several of the crates and their contents. Comparing with the manual, he looked over their controls carefully, then called to Mannin to come down. "Look here," he said, "when they packed these things, each wrapper apparently had a thick fold over the controls. When the cover was packed in place, it threw the switch. But look here. It was the switch to Pilot Sub-Circuit A.

Mannin stared. "Then what's the main circuit like?"

"I'm afraid to try it here," said Nevv. "Wait till we lift ship.

They climbed down.

By this time, successive shouts from outside told of new arrivals, and when Nevv and Mannin looked out, they saw at a distance heavy long tables and benches, a big fire with a glowing bed of coals raked off to one side, and a large animal on a spit being turned over the coals. Another glance showed men swinging huge mauls to drive stakes into the ground around a massive square of logs. On the square rested a platform bearing a low upright framework with a large heavy case thrust out in front, and a series of things like short thick giant spoons thrust out behind. A man stepped forward and tugged on a rope. One of the spoons snapped up and around, and slammed against a padded beam. A streak shot out, and a swirling puff of dust climbed up about a hundred and fifty yards away.

"Look straight down," said Mannin.

Nevv looked down and saw men working on a scaffolding that was rising fast at the base of the ship.

Nevv's mouth opened and shut.

Down on the ground, a man with a mallet walked over and struck a big, yellow-metal gong. People began to run toward the tables.

The Inspector walked over and looked up. "The victory feast begins," he called. "We will celebrate your coming destruction of the thieves. You must sit at the head."

Nevv glanced desperately at his watch. "*Our* custom," he called down, "is to celebrate *after* the victory."

The Inspector looked shocked. "You might be dead then." He glanced down and said something that sounded like, "Why, that's barbarous!" He looked up again and loudly called out. "You must be our guests now, otherwise we will *have* NO FEAST!"

A silence fell over the hurrying people, who stopped and began looking first at the feast being carved from the spit, and then up at Nevv. There was a low, swelling mutter.

Nevv glanced up and saw several men by the log frame. They were walking slowly around it, pushing on a long pole. The frame with attached spoons was swinging slowly around.

Nevv did a fast mental calculation: Two hours in subspace to get back to where they were when they'd decided to come here. A five-hour detour to get on course. Twenty-seven to twenty-eight hours more till the last breakpoint. He glanced at his watch. Well, they had time left, but what if they needed it later on?

The muttering down below had turned into a waiting stillness.

Nevv looked at the big frame. He glanced inside at the fuel feed mechanism. He looked around the interior of the ship and saw some eight to ten muscular figures swinging down from overhead struts and beams. He let his breath out sharply and said to Mannin, "Have you got any ideas?"

"Not a one. I only hope this feast doesn't last all night."

Nevv suddenly remembered the Inspector's pronouncement about the ropes that held them being cut and thrown in the fire, and the prompt action to cut off just a small length and throw *it* in the fire.

Nevv leaned down and called out, "Let your custom be our custom. We will come down and join you at the feast."

A scattered cheer came up. The Inspector looked relieved. The rush for the tables picked up where it had left off.

Nevv had expected to escape from the feast after a comparatively short time. The feast, however, went on and on, darkness settled down, torches were lit, and as the copious gallons of drink poured out began to affect the revelers, they showed such a capacity for involved hair-splitting discussions that Nevv began to wish he had never heard the language. To Nevv's right, for instance, sat Netsil, the famous scientist. It was Netsil who had designed the Big Arm, which had just helped Nevv to decide whether or not to stay for the feast. Just beyond Netsil sat the Inspector, and beyond him sat Mansen, an elderly man, still considered a great scientist but now thought second to the younger Netsil. Mansen, Netsil, and the Inspector grilled the Terrans on all phases of their life, and uncovered countless inconsistencies.

The Inspector, swinging a big gourd full of liquor, finally said belligerently, "You Wizards, why don't you come down to earth and live like honest people?" He took a drink. "No offense." He took another drink. "But what have you got? Oh, you whiz through the air by magic, appear and disappear, materialize huge huts of no earthly substance. But what does it all mean?" He jabbed out a finger. "Do you *really* know what you're doing?"

Netsil took a draught from his own gourd, and leaned forward. "We *would* like to know some more details," he said persuasively. "We don't get to talk with sorcerers very often. You know, I have a favorite theory. I think there's a solid substructure of science somewhere under your magic, even though you may not know it."

Nevv, exasperatedly trying to see his watch, growled, "*Everything* we do is science. That's what we've been trying to tell you."

"How," said Netsil gently, "can that be? A scientific process, you admit, is perfectly reproducible. Now, from what you've told us, many of your processes work, or don't work, unpredictably."

"That," boomed the Inspector, "is just what I say. They don't know what they're doing. No offense." He drained his gourd, and scooped it into a big bowl at the center of the table. He fixed Nevv with one eye while the other roamed around at random. He took another sip.

Nevv glanced at the ship and tried to calculate just what would happen if they quietly got up and headed for it. He didn't think the Inspector was quite drunk enough yet.

Mansen leaned forward. "I have my own theory. And perhaps Netsil and I can both learn more if you will concentrate on one scientific device of yours."

Netsil drained his gourd, got up, refilled it, and swaying slightly, came back. He bowed to Mansen, "Exactly what I was about to suggest, Professor." The word "Professor," was in Terran. Nevv considered that one hundred and sixty years ago the people on this planet were just nomads. Now they had "professors."

Netsil took a long sip from his gourd. Mansen and the Inspector were watching attentively. Netsil said, "One scientific device—let it be a practical one."

"Well—" said Nevv, and was suddenly brought up short by the thought of what his hypnotically conditioned vocabulary was likely to do when he came to unfamiliar scientific terms. He glanced at the Inspector, who was now waving his gourd like a baton, with only an occasional glance at Nevv and his companions.

"Well?" said Netsil. "Your practical device?"

It suddenly dawned on Nevv that "practical" was in Terran, too. Nevv wondered briefly just what frustrated Terran professor had gotten marooned on the planet some time in the dim past. He collected himself, thought for a moment, and said, "All right. Let's take the case of a simple device we use to power light . . . er . . . carts, boats and so on."

"Can you," said Netsil, taking a sip from the gourd, "explain it so others could make one and use it? That's an important point."

"Yes. At least, I can explain it," said Nevv belligerently. "It's a simple gasoline engine. Basically—"

Netsil and Mansen looked at each other. Netsil cleared his throat. "Gasolinen djinn," he said.

"Basically," said Nevv, feeling himself redden slightly, "it's a cylinder . . . a hole . . . and a piston that moves up and down inside of it. Gasoline is squirted into it. The gasoline—"

"One moment," said Netsil, putting his hand gently on Nevv's arm. "The gasolinen djinn is a hoop, and a magic wand that flies up and down inside. A potion is sprinkled over it—"

"No, no," said Nevv exasperatedly. "It's all perfectly scientific. This gasoline isn't a potion. It's a liquid—like water. There's a flash—like a little bolt of lightning. It ignites the gasoline. The gasoline catches fire. There's an explosion. That is, a big bang, like thunder. It drives the piston down. This gives the power. The strength. Then we attach it to a . . . say" Nevv groped for a word, "a winch. It's the winch that does the work. There—" He mopped his brow. "It's all scientific."

"Ah-h," said Netsil, rolling his yes. "Ah, yes. Scientific. Let's see now. You have a hoop—"

"It's not a hoop. It's a hole. A space. An emptiness. The wand—I mean the *piston*. The piston fits tightly inside of it."

"Ah, hm-m-m. You have an emptiness, then. The wand fits tightly inside the *emptiness*. Water is sprinkled over it. Lightning flashes. The water . . . *water,* mind you! . . . bursts on fire. There's a roar like thunder. The wand flies down. This gives strength to the . . . did I hear you correctly? . . . to the witch. And you say it's the witch that does the work."

Nevv shook his head and groped for words.

Mansen said, "Now, my theory, Netsil, allows for this. These people, who we call 'wizards,' *were* scientific once. Observe the logical reasoning from point-to-point. It's the content that seems meaningless. Even here—"

"Gibberish," snapped Netsil, "hoops, wands, witches, thunder and lightning, burning water—"

"It may all have some meaning we don't understand," said Mansen insistently. "My theory is—partly, of course—that a science and perhaps a scientific people—like everything else, has a rise and a fall. A peak is reached, then, as it were, it bears fruitful offspring; these offspring grow—"

Netsil, red in the face, glared at Nevv and snapped, "This djinn of yours, does it . . . he . . . whatever it is . . . always work?"

"Always? Well, no. Not right away. Sometimes it takes a while. It takes a knack—"

"Aha! A *knack*. Some can do it better than others?"

"Well, yes."

"Why?"

"I don't know. Some people seem to have a way with them."

"Will it work for the same person at some times and not at others?"

"Yes, on cold days—"

"Aha!" growled Netsil, swinging around to glare at Mansen. "When the moon Skybird is over the moon Bright-One, and the night brings frost to the valley, dance three times around the toadstool and the thing will work. Otherwise—"

Nevv felt his ears get red. He started to interrupt, then saw the Inspector stretched out on the table, snoring.

"Science," said Netsil very firmly

and finally, "*Always* works for *anybody,* and it *always* works *anytime.*"

Nevv kicked Mannin under the table and jerked his head toward the ship.

"Science," said Mansen, "may be in different stages. Now a bowman practically always hits a fair target, Netsil—when he's grown up. As an infant or as an old man, however—or when not at his best—or with an unfamiliar bow—"

Nevv eased carefully away from the table.

"That," roared Netsil, "is an unscientific comparison, professor. For instance, the infant isn't a bowman till he's grown up!"

Nevv and Mannin cautiously got up. Hughes swung a leg carefully over the bench.

"Where," asked Mansen, "are you going to get bowmen, if you kill the infants, Professor?"

Nevv whispered, "Walk fast, but don't run."

Sounds of violent argument dwindled behind them as they wound past festive tables toward the ship.

They clambered rapidly up inside, checked to see they had no unexpected guest, then Nevv hastily explained his plan.

The take-off, once they managed it, was unevenful. Nevv, in the spaceboat, listened as Hughes and Mannin discussed matters in the control room.

"We might," said Hughes, "be able to speed things up when we go into subspace by trying a fast spin. After all, if it threw us *off* course—"

"Nothing doing," growled Mannin, "we'll just have time to get things done when we said we would if nothing else goes wrong."

Finally Hughes said, "Dave?"

"Yeah," said Nevv.

"We're free of the planet. If you want to try that now, I can cut the acceleration."

"O.K.," said Nevv. "Open the space doors in the hull." Very cautiously, he began to work the spaceboat controls.

Hughes, up in the pilot room, swung open the ship's big space doors, and Nevv could look down and see the stars outside.

Slowly, the spaceboat began to move.

Once Nevv had brought the spaceboat back into the ship, and they were on their way through subspace, Nevv's mind began uneasily sorting things over. He mentally went through the steps of his plan, picturing his actions carefully and vividly, till he thought he could carry them out, if necessary, with hardly any conscious attention at all. The trouble was, he thought, that some thorny little detail might sift in unseen and ruin everything. He twisted around in his seat and spoke into his microphone, "Phil—"

Mannin's voice said, "Yes, Dave?"

"Are you sure you can bring us out near that asteroid belt?"

"Near," said Mannin, "but not at. If I try to bring us out *at* it, we're too likely to have a collision."

"O.K.," said Nevv. He sat back

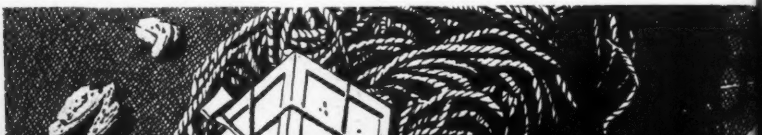
and wondered, first, whether the Flats would detect and blast them the instant they came out; and second, if they didn't, whether Hughes' lightning-bolt maneuvering would get them into the asteroid belt without at the same time ripping the ship to pieces.

A comparatively small amount of this speculation put Nevv in a frame of mind like that of a man on trial for murder, waiting while the jury deliberates.

It took a hard effort to put his mind on the problem of finding something he could think about till the ship came out at its last breakpoint. For a while, he thought about the argument between Netsil and Mansen, and Mansen's question: "Where are you going to get bowmen if you kill the infants?" Sleepily, Nevv thought, "Where are you going to get new sciences if you deny the first unexplainable facts?" His mind went around and around on the question, and his head slumped sidewise on the padded acceleration seat of the spaceboat.

Nevv dreamed that a giant with a great bow and a sheaf of arrows was crying out in pain, and when Nevv went close, the giant was just a little baby crying.

There was a din in Nevv's ears that started to shake him awake, and it seemed that he was standing side-by-side with a giant who drew



back his bow and sent shafts of pure energy out into space.

"Dave," cried Hughes' voice, "it's breakpoint! Can you hear me?"

"What?" Nevv sat up. "It can't be."

There was the soft chime of a bell over the earphones, then a wash of colors. Then a violent slam back into the acceleration chair as the ship sprang forward, swung head-for-tail, then braked hard.

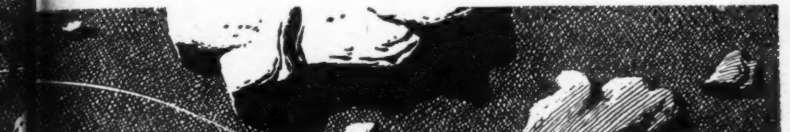
Nevv's hands went to work automatically. He swung the spaceboat carefully through the stripped frame of the ship, dipped down through a large empty cell in the cargo web, came gently up again, and watched the net grow slightly larger above him. He loosened the wide belts of the acceleration chair, and put on the bulky spacesuit.

Beside him, the big space doors of the ship swung slowly open.

The spaceboat pressed gently into the net, and began to spring back.

Nevv swung his arm forward, feeling clumsy in the suit, and pushed down the evacuator stud. He heard the *chug* of the spaceboat's compressor sucking air out of the cabin and passing it back into the tanks. The *chug* grew fainter as the pressure dropped.

Nevv glanced out, saw that the boat was starting to spring away from the net. He opened the hatch, check-



ed to see that he had the rope, which he could hardly feel, in his hand, and pushed gently away from the spaceboat. He drifted to the cargo web, caught hold, and clumsily tied the rope to the web. Then he pushed off of the web toward the spaceboat, which was drifting slowly away.

Nevv tied the rope to a ring on the side of the spaceboat, got the hatchet, and pulled back on the rope toward the web. He made his way to the side of the web away from the space doors, and chopped the big cables free of the springs. The springs on the other side contracted, pulling the net toward the space doors.

A sudden intense white light lit the inside of the ship for a moment. Nevv glanced out through the doors and saw a distant asteroid glow white. The Flats were in action.

Nevv went carefully around the inside of the ship, till he had completely freed the web at the edges. He pulled himself back to the spaceboat, rechecked a small oxy-acetylene torch, went back, and cut free the ladder that passed down through the center of the net. He got back into the spaceboat, and very gently applied the power. He glanced back to see that the net was trailing, and swung out past the big doors.

In front of him, he could make out a cluster of dark slowly turning objects about twenty to forty feet thick. There was a wide empty space, then he thought he could see other, larger, objects turning in the distance. He had the impression of being rushed along in a giant stream of widely separated bits and pieces.

To one side, there was a brilliant flash of light, then another, and another.

Nevv crawled out the spaceboat hatch and pulled back along the rope to the web. Holding the torch and trailing the hatchet on a short length of rope, he glanced around for the two crates he had used to test with. He saw the web was hopelessly tangled, switched on the suit's headlamp and one after another carefully cut loose the two nearest crates he could reach. He ripped the crates open with the hatchet, managed to get the cylindrical drive units separated from the boards and wrappings. He concentrated on a mental picture of the two units swinging base to massive base.

Before him, the two units tipped slightly, and like two magnets, turned and swung together, base to base.

A brilliant wash of light lit them, and Hughes' tense voice whispered in the earphones, "Ready?"

"Almost."

Nevv pictured the drive units coming closer to him, then blanked his mind as completely as he could. He reached out, the suit-light shining on the control panels, switched off Pilot Sub-Circuit A, and switched on the Main Drive Circuits. Nevv pushed off gently for the web.

"O.K.," he whispered.

The units spun as one, wavered, swung together in a narrow cone, then dove down at an angle away from the ship.

Nevv pulled along the rope and began to cut loose another crate.

Mannin's voice spoke in his ears.

"Attention all ships, Killer Group One: Bombardment Division: Fire by salvos. Light Units Two and Three: Torpedoes ready. Prepare to close."

A brilliant blaze lit the cargo net. A burst of blue-white lines starred out and streaked past to his right.

He tugged at another crate, pushed the tangle of ropes and cable away from it, and began to chop at the edge of the case.

A thing like a long, oversize oil drum shot past him, paused, sprang away, hesitated, lit by the dying glow of an asteroid, sprang up, appeared hovering near the nose of the ship, shot down and out of sight.

Nevv glanced up again from the crate. Far in the distance, a brilliant point of light flared into view. Not far away, there was another bright flash. Then another.

The drum shot into view, paused by a brightly-glowing red asteroid fragment, dropped and vanished. Where the glow had been, was a narrow red streak, stretching out and away to a tiny red dot far-off.

A series of brilliant flashes lit up in the distance.

A half-hysterical garble sounded in Nevv's earphones. Mannin's voice said steadily, "No terms whatever. We don't want your surrender. Just get out. And you'd better make your peace before the Main Fleets get back."

Nevv took a deep breath of the stifling metal-and-rubber-smelling air in the suit, gagged, and began working the tangle of ropes back around the case. He tied them clumsily, started back toward the spaceboat, then stopped. He glanced toward the ship, formed a mental picture of the crates and net moving back toward the space doors, and felt the rope to the spaceboat tighten. He glanced back, looked ahead, and piloted the boat back into the ship by means of the cargo. As he passed through the big space doors, an elongated cylinder shape moved through behind him.

Hughes' voice, shaking with strain, said, "Put them back on the pilot circuit, Dave."

Nevv pushed away, caught hold of the cylinders, and carefully set their switches.

Prometheus began to move. Nevv got the spaceboat in its cradle. He let the air back into the boat, and with a sense of great relief, got out of the suit and took a deep breath. He glanced back and saw the cargo bunch itself in the center of the aft section of the ship. He stripped open an emergency food packet and settled down. He felt the ship swing forward fast, and sank back in the cushions. He was wondering uneasily just who had commanded the Flats outside.

Hughes said, "Where to?"

"Contact White Base and tell them we have a slightly damaged ship to bring down. Tell them our hull's punctured and our fuel feed's hurt, and ask if they can take care of us."

In a moment, Hughes said "Yes."

"White Base, then," said Nevv.

White Base had the look of a fortress that has had the upper works so pounded into rubble that they serve merely as a buffer to protect the parts underneath. But the bulk of the grimy men who greeted Nevv, Hughes, and Mannin could not have seemed much happier. Each wore a grin of fierce delight and went to work on the ship's hull as if possessed of supernatural strength.

The moment the hull and the feed mechanism were repaired, Nevv glanced at Hughes. "O.K., back to the asteroid belt."

Hughes had his head in the pilot globe. "By the drive," he said, "or by the cargo?"

Nevv stared at him. "By the drive."

The ship lifted, and Nevv said to Mannin, "Who was in charge of the Flats here?"

"Somebody with four tufts on his sash, a collar full of hair, and a gold cactus on each shoulder. I was so nervous that's about all I saw of him. I hope he thought I was mad."

Hughes said, "You want me to contact the colony?"

"Stay right where you are," said Nevv. "Phil, get in touch with the colony. Send 'Have cargo for you. Shall I bring it down?' Send it in the new code."

"Right," said Mannin.

Hughes said, "Do you have something in mind for me?"

"Yes. I'm going to reactivate those two drive units. Then I want you to get them outside."

"Wait," said Hughes. "I think I can do it myself by swinging one of the others down. I didn't think of it before." After a moment, he said, "O.K. You want them outside?"

"Yes, as soon as you can get them there."

There was a faint rumble, and a trembling underfoot as the space doors opened. "O.K.," said Hughes.

Mannin said, "The Colony answers, 'Keep cargo. You're doing fine.' "

"Send 'Will keep cargo.' " Nevv glanced toward Hughes. "Did you have any trouble back there?"

"Just sheer nerves, that's all. I was afraid a chance hit might get us before we got into action. Then I thought I might do something wrong."

"How was the aiming?"

"Not bad. The pressure of the two units locked them together. As the detectors spotted a target I lined the drive unit up on an asteroid, chunk, or fragment along a target track, then jammed on full acceleration. The drive units stood still, balanced. The drive played on the fragment in a narrow beam, kicked it forward, accelerated it, and I guess built it up to somewhere near the speed of light before it hit. The impact must have been terrific."

"Could you work better with another set of them?"

"No thanks. One's enough."

Mannin said, "Anything more for me to do?"

"Not just yet. Keep your eyes open, and tell me if any Flats show up. Hughes will be too busy."

Hughes abruptly sucked in his breath. "Very far right foreground high. One ship."

Mannin sprang across the room.

Nevv stiffened and watched the viewscreen.

"Shall I hit him?" said Hughes.

"Not yet."

The screen flared. The white-haired Flat, his many-tufted sash drawn taut across his chest, looked at Nevv with his face cool and immobile.

Nevv looked back at him.

Finally the Flat said, "If this isn't a bluff, none of it makes sense."

"If it is a bluff," said Nevv, "it's a painful one. Do we have to bluff you again?"

"Where are your ships?"

"Not *my* ships, Admiral."

"You seem to be the spokesman."

Suddenly Mannin said, "Near right foreground high, low, dozens of them—"

Nevv said, "Fire at will."

Hughes' tense irregular breathing was the only sound Nevv could hear in the room. Then there was a light *ping* sound, such as a light fragment might make bouncing off the wall of the ship. Nevv kept his eyes on the white-haired Admiral. Abruptly, the Admiral said with his face slightly twisted and the corner of his mouth drawn down, "Enough."

Mannin said, "They're gone. All but one. Very far right foreground high. That's gone. Near right foreground high."

On the screen, the Admiral flickered off, then on.

Nevv snapped, "Hold fire, all Groups."

The Flat looked at him steadily. Then he vanished from the screen.

"Gone," said Mannin.

Nevv said, "If any Flat ship shows up again anywhere in range, obliterate it."

Hughes said, "Why not that last one?"

"I don't know," said Nevv, feeling his shirt cling to his chest and back.

Mannin said, "Why didn't he take us?"

"Again I don't know." Nevv took a deep breath. "Send to the Colony: 'Request suggestions for disposition of cargo.' "

A few moments later Mannin read: "Return cargo your base immediately." He looked at Nevv.

"That's the message."

Nevv, Mannin, and Hughes looked at each other.

"Plot a course," said Nevv dryly.

Hughes sucked in his breath and said, "You want the . . . cargo back inside?"

"Yes," said Nevv, "as soon as the course is ready."

Hughes said in a tense voice, "Do you mind if I deactivate the Main Drive Circuits now?"

"Go ahead."

The trip back was so totally uneventful that when Nevv, Mannin and Hughes stood before General Lawson, none of them could think of anything to say about it.

"We just came back," said Nevv. "We caught up on some sleep, that was all."

The general said, "You'll each be advanced one grade in rank, with full seniority as of the date of your first encounter with the enemy. You'll each be given the highest decoration that we can bestow. Other than that, what you've done must pass totally unnoticed. We're trying even now to find out some way to maintain this secret that won't be unreasonably hard for you."

"Sir," said Nevv, "this must have been a hard secret to keep."

"It has been."

"Sir, *why* keep it? With this, our colonists could do anything."

The general smiled faintly and looked steadily back at Nevv.

Nevv stiffened suddenly, and felt very cold.

Mannin said, "Sir—" then abruptly cut himself off.

The general looked at Hughes. "What was your reaction to it, colonel?"

"After a few minutes of it," said Hughes, "I never wanted anything more to do with it. Suppose I should make a mistake?"

The general nodded and glanced at Nevv. "If that were the universal reaction, why, of course we needn't keep it secret. But consider the possibilities. The destructive power of new developments goes up and up, but where is the defense? Suppose *one careless or ill-intentioned person should get hold of this?*"

Mannin said, "And yet it could mean so much—"

"That's just it," said the general. "It could and perhaps some day it will. The race evolves. You three men, for instance. You took it out; you used it as best you knew how; you brought it back sheathed and safe." He cleared his throat. "We could trust *you*."

He raised his hand in a brief salute, and said:

"We'll share the secret, but heaven help us.

"Some things can't be shared till you can trust *everyone*."

THE END

IN TIMES TO COME

The editorial chronoscope, whereby we precog the future, developed a fault, somehow, when we were making up the July issue; Christopher Anvil's "Foghead" announced for the next issue, obviously isn't. Oh, well, the best of time-machines slips sometimes . . . and maybe it was some of the fog from "Foghead" that befogged the issue. Anyhow, the story is, if we're not still befogged, due in the September issue.

THE EDITOR.

EVERY ASTRONOMER HAS HIS HORROR STORY

BY ROBERT S. RICHARDSON

Astronomy is, above all other sciences, time-bound. And that means it can offer the ultimate in frustrations. The pretty fluffy white cloud in a serene blue sky . . . that floats in front of the Sun at the moment of total eclipse, for instance. . . .

ONE of the troubles with scientific papers today is that they sound as if they were all written by the same person. Every trace of personality must be carefully deleted. You give a terse description of the instruments, the method of observation, the observations themselves, and the results obtained. Also, most papers sound as if the author never made a mistake, but proceeded with perfect logic from one step to another to the final inevitable conclusion. Of course scientists make mistakes all the time. If any scientist put down half the mistakes he made during an investigation the length of his paper would be doubled, and scientific journals are already loaded to capacity.

Scientific papers were not always written thus. A century ago when a scientist wrote a paper he not only told you about his subject. He also told you a good deal about himself. He gave you a running account of his hopes and fears, and his moments of doubt and uncertainty. There is an effort on foot today to glamorize science by telling the youth of the country how wonderful and exciting it is. Heck! You don't need to glamorize science. All you need to do is to tell about it in a way people can understand.

Let me show what I mean by quoting from a paper that is now considered a classic of science. It is the paper in which Sir William Huggins* describes his discovery of the nature of the gaseous nebulae. Huggins was a pioneer in the use of the spectroscope. Apparently he had just attached a spectroscope to his small telescope and after some difficulty had finally gotten around to observing with it.

"On the evening of the 29th of August, 1864, I directed the telescope for the first time to a planetary nebula in Draco. The reader may now be able to picture to himself to some extent the feeling of excited suspense, mingled with a degree of awe, with which, after a few moments hesitation, I put my eye to the spectroscope. Was I not about to look into a secret place of creation?

"I looked into the spectroscope. No spectrum such as I expected. A single bright line only! . . . the riddle of the nebulae was solved. The answer, which had come to us in the light itself, read: Not an aggregation of stars, but a luminous gas. . . ."

Would Sir William be able to get all his palpitation and soul searching past the editor today? Not a chance. Instead his paper would read something like this:

"Observations of the planetary nebula in Draco (NGC 6543) were made 1864 Aug. 29, about 9 hours GCT. The nature of these objects has been hitherto unknown. Preliminary observations with the new spectroscope attached to the 8-inch refractor revealed a line at approx. 5007A, with weaker emission at 4959A and 4862A. It seems not improbable therefore that these nebulae consist of a luminous gas rather than an aggregation of stars as sometimes supposed. A detailed account will appear in the *Proceedings* of the Royal Society. . . ."

I might quote one more example, going back to an account of the big cold wave that hit Glasgow in January, 1768, written by A. Wilson*, a professor of mathematics. Professor Wilson did not hesitate to give the reader an intimate picture of his home life which a scientist today would consider unthinkable. Wilson starts off:

"Whilst in bed, on funday morn-

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*Quoted from *Spectra of Nebulae, The Nineteenth Century Review*, June, 1897.

Philosophical Transactions of the Royal Society, Vol. 61, p. 326, 1771.

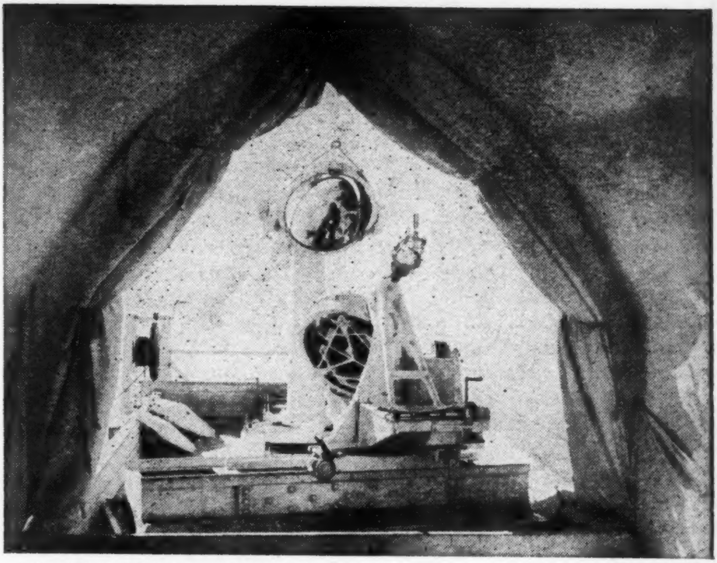

Fig. 1: The coelostat and flat of the Snow telescope on Mount Wilson where most of the observations of Venus were made. First the large coelostat (lower) mirror was maneuvered until the image of Venus could be seen in it. The light from Venus was then reflected to the upper mirror. This mirror then reflected the light about two hundred feet to the north—in the direction of the reader—to a third concave mirror. The concave mirror reflected the light to another mirror, onto the slit of the spectrograph. All four mirrors had to be lined up every night to observe Venus.

ing, January 3, 1768, about 8 o'clock, it felt fomehow unufually cold. A little while after, on reaching out for a decanter which I had placed near me the preceding night, with fome water* in it, I was furprized to find the furface of the water frozen over, the like not having happened before in that place . . ."

There is no point in converting this into the language of today because such a paper would never get into print in the first place. The temperature of Glasgow would appear merely as a statistic in the *Meteorological Review.*

The foregoing remarks occurred to me after having just finished writing a paper on the spectroscopic rotation of Venus for the *Publications* of the

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*Or so Prof. Wilson says.

Astronomical Society of the Pacific. The paper sounds as if everything went along without a hitch. Whereas looking back I often wonder how I managed to survive it at all. Possibly a personal account of the proceedings may be of interest, not because they are of any importance, but because they may help to dispel the ivory tower attitude with which the public persists in regarding the astronomical profession. Also, readers may like to hear the latest results on the rotation of Venus.

Since Venus is perpetually covered by clouds its rotation period cannot be determined from observations of surface markings. The rotation period of Mars is known to within a hundredth of a second, and possibly even closer. It is true that diffuse markings have been occasionally seen on Venus, but the rotation periods determined from them are so contradictory as to be practically useless. Markings can almost always be photographed on Venus in ultraviolet light, but they are of a banded type, and hence of little use for determining rotation. (We shall have more to say about these ultraviolet markings later.)

This would seem to be an obvious problem for the spectrograph. On the side of Venus approaching the Earth the spectrum lines should be shifted toward the violet. On the side of Venus receding from the Earth the lines should be shifted toward the red. By measuring the shift we should be able to tell which way Venus is rotating and how fast. The last spectrographic measures on the rotation of Venus were published by V. M. Slipher at the Lowell Observatory in 1903. He found no significant shift due to rotation. Some work on the rotation of Venus was also done at the Mount Wilson Observatory about 1923, in the course of another investigation. The observers there were also unable to detect any shift due to rotation. So far as I am aware no other spectroscopic work has been done on this problem.

With the fast photographic emulsions now available it seemed to me the problem might be attacked anew with some hope of success. Accordingly, I planned to take spectra of Venus in the spring of 1956, when the planet was in the evening sky at a good elevation for observation.

The next question was what instrument to use. The natural answer would seem to be one of the spectrographs at the 100-inch or the 200-inch telescopes. The trouble was you couldn't use these instruments whenever you liked. A lot of other astronomers wanted to use them, too. But I felt it was highly essential that the instrument be available for observation whenever I liked. I finally decided to use the old Snow* telescope on Mount Wilson, which had some drawbacks, but which also had several distinct advantages in its favor. Although designed exclusively for solar work, and in use on the sun every day, it was available for use on Venus every evening. The scale of the spectra was also much larger than at any of the telescopes. At any rate, I decided to go ahead at the Snow building.

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*Named for Miss Helen Snow, of Chicago, who in 1905 provided sufficient funds to complete the building.

George Ellery Hale, founder of the Mount Wilson and Palomar Observatories, once remarked that they never bothered to design the Snow telescope. They just went ahead and built it. It is a long ramshackle structure filled with queer recesses, unexpected nooks and crannies, and shaky stairways. Bats and mice are frequent visitors, and once a rattlesnake was found coiled up asleep on a can of paint. In the evening air currents begin circulating among the louvres producing strange sighing and rumbling sounds like lost souls in distress. It would make an ideal abode for Charles Addams characters. Best feature about the building is that it does not contain a telephone, thus enabling you to work for hours without fear of interruption.

Aiming a telescope at an object as bright as Venus is a simple matter. All you need to do is to sight at Venus along the top of the tube. For a large telescope you look up the position of the planet as given for each day of the year in the *American Ephemeris,* published by the Naval Observatory. Then you point or "set" the telescope at this position. Usually the planet will be found near the center of the field of view.

I usually drove up on Mount Wilson so as to arrive about thirty minutes before sunset. Now you can't point the Snow telescope at anything. To pick up Venus first I located it with some field glasses. Then I maneuvered the large mirror shown in Fig. 1 around until I could see the planet near its center. Next the mirror mounted above it was adjusted to reflect the light of Venus to a third concave mirror about two hundred feet to the north. This concave mirror in turn reflected the light of Venus to a fourth mirror, which formed an image of the planet on the slit of the spectrograph. I had set up a sight about one hundred feet north of the second mirror. When I could see Venus through this sight I knew I was getting close.

Now it is easy to adjust the mirrors when you are working with the sun, and have a bright beam which you can see. But Venus is an entirely different proposition. I started by getting the first two mirrors roughly into adjustment. Then I took a look through the sight. Then I went back and adjusted the mirrors some more. Then I took another look through the sight.

This can get to be rather strenuous after you have done it a few dozen times. It would not have been so bad if I had not always been pressed for time. But I had to get all four mirrors into alignment so I could start exposing soon after sunset, since the exposure time on Venus was at least an hour.

White-coated scientists accustomed to working in a modern laboratory with hordes of assistants at their beck and call doubtless would have scorned working under such primitive conditions. But then they would have missed the benefit that comes with exercising in the fresh cold mountain air, especially at an elevation of a mile when you are not accustomed to the altitude. I regained some of the agility of my youth in side-stepping and hurdling the various obstacles in my path between the mirrors and the sight. In fact, by the time I was through observing Venus at the Snow telescope I had developed into a pretty fair broken field runner.

My first spectrum of Venus turned out better than I expected. (I hadn't expected to get anything at all.) I don't mean it was good, but at least it was worth measuring. The quality of a plate depended mainly upon the seeing and guiding. When the atmosphere was steady and the seeing was good the mirrors formed a beautiful image of Venus on the slit of the spectrograph about one quarter of an inch in diameter. You tried to keep the image of the planet fixed in position on the slit by guiding with slow motion controls. Since these controls were the same ones that had been installed fifty years ago their action left something to be desired in the way of precision instrumentation. You didn't just start in to guide. You had to *learn* how to guide, in somewhat the same way that you have to learn how to operate the stops on an organ. Some nights I had good luck with my guiding. On other nights it seemed impossible to press the right button.

As I said, the first plate wasn't so good. But the second night everything went much better. Seeing and guiding were both good. The plate came out of the developer just about the right density. I carefully put the plate in the drying cabinet and drove home feeling very well pleased with myself.

The next morning I had scarcely gotten to the office when the blow fell. A man on the mountain called to tell me he had just taken my plate of Venus out of the drying cabinet. The same drying cabinet we had been using for years. Never had a bit of trouble with it until I put in my plate of Venus. The emulsion had melted! The spectrum had gone into the cabinet as a sharp straight line. It came out looking like something from an impressionistic painting. Needless to say this was the last photograph of Venus that ever went into the drying cabinet. (But you won't find anything about it in my paper.)

There were a host of other minor mishaps but on the whole the program at the old Snow telescope went fairly well. There was the time when I tried to develop my plates in the darkroom, and found that the water instead of running outdoors went straight through the sink on to the floor, but that is hardly worth mentioning. By the end of May, when Venus had started its plunge in front of the sun, I had accumulated twenty-eight plates ranging in quality from fair to good.

The car I had been driving up and

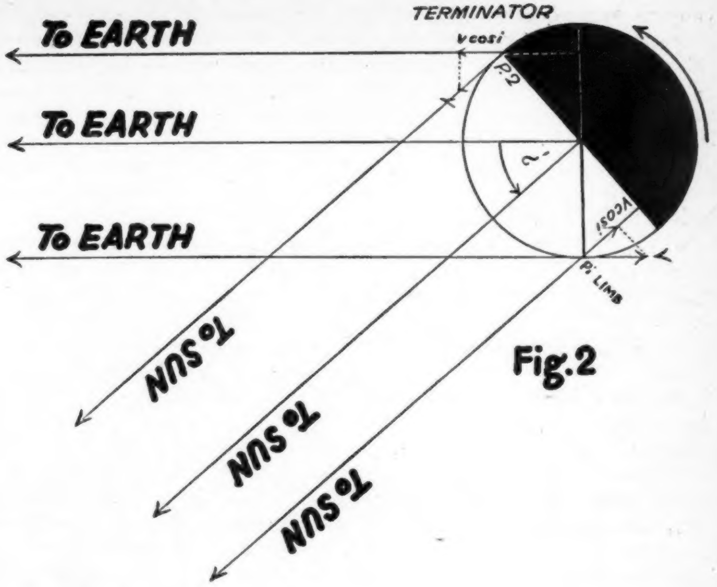


Fig.2

down the mountain was a 1941 model that had been running on borrowed time for many years. By some miracle I had made every trip without a blowout or engine trouble. But now there was no use denying the fact: the time had come for us to part. My wife, who is rather inclined to be sentimental in such matters, felt I should go on having the car repaired. Her attitude toward the car was like that an owner used to develop toward a horse that had served him long and faithfully. She felt the old car should be treated with kindness and its whims and eccentricities regarded with tolerance and sympathy. But I refused to listen, so the car was traded in on a flashy new secondhand model that caught my eye, and which seemed to perform all right when I gave it a brief run up the mountain.

I had not driven the car for long, however, when it began consuming oil at a tremendous rate. It became necessary to put in oil practically every day. When I started down the street smoke rolled out of the exhaust in such quantities that it was positively embarrassing, especially in southern California where anyone who contributes to the smog is regarded as a social outcast. I poured magic potions in the gas tank that were supposed to clear up my oil problem, none of which had the slightest effect whatever. Still the car continued to function after a fashion.

To return to Venus. . . .

It is always a good idea to check your results by taking observations in as many different ways as possible. Hence I had planned to photograph Venus with one of the spectrographs at the 100-inch telescope when the planet was in the morning sky. Since I only needed the instrument for about thirty minutes at the end of the night, I had gotten permission from the astronomer in charge to take over beginning at 4:30. I planned to leave home about two o'clock, which would give me plenty of time to drive up the mountain and get all my plates, filters, et cetera, arranged at leisure. I was anxious to observe Venus as near full phase as possible, which meant that I had to work very fast shortly before sunrise. The spectrum of Venus can, of course, be photographed in full daylight, but there are objections to such a procedure. Also, it is against the rules to observe when the sun is up, since the heat spoils the figure of the mirror.

I was in high spirits as I headed for the mountain that morning. I had filled the car to the brim with oil and figured I should have no trouble. We had another car that I might have used, but as it is considered the special property of my wife, I am only allowed to drive it on extraordinary occasions. There is an excitement about doing something wholly different from your regular routine. As I sped along I could not help thinking how different was my mission from that of other people on the road. Most of them were probably returning from parties, or hurrying home from some commonplace job that kept them up till after midnight. But how many could say they were faring forth to observe another world?

As I turned into one of the busiest streets in town I suddenly became aware that something was drastically wrong with the car. The engine still worked, but it had no effect in propelling the machine in a forward direction. I had enough momentum left to roll around the corner. After which the back wheels fell off and the car, so-to-speak, sat down in the middle of the street.

I found a pay phone and told my wife to come and rescue me. Then I called a towing service. After which I went back to contemplate the wreckage. My wife arrived in a few minutes with a coat thrown on over her night dress. We waited and waited but there was no sign of the tow car. My automobile was right in the middle of the street and machines were whizzing dangerously close to it all the time. The front headlights still worked but of course there were no lights in the rear. I called the towing service again and went back and waited some more.

During the next hour I came to the conclusion that there are many people

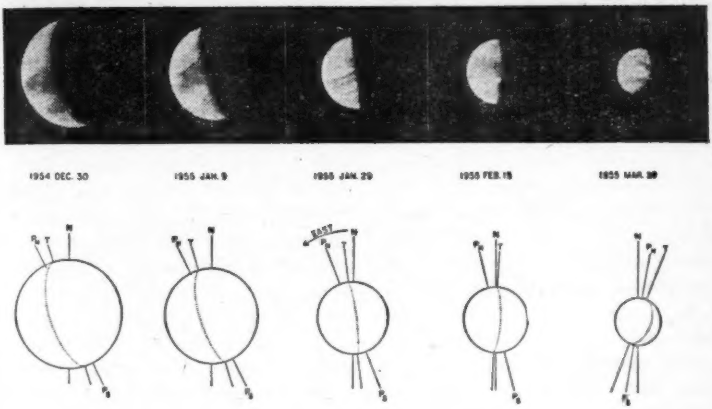


Fig. 3: Drawings of ultraviolet photographs of Venus made by Chesley Bonestell. The orientation of the axis of rotation of Venus was determined from the stronger bands shown on the image of January 29, 1955. The difference in size of the images is due to the changing distance of the planet from the Earth.

in the world much more kindly disposed toward their fellow men than myself. I don't believe I have ever in my life particularly gone out of my way to help anyone else. But a remarkable number of people came to my assistance. A car pulled up to the curb, a youth in a leather jacket jumped out, and headed for my wreck. I immediately concluded he was one of these juvenile delinquents bent on mischief. Instead the kid began waving traffic around my car with a flashlight, something I could have done just as well, if I had had the sense to think of it. I thanked him and got busy with my own flashlight. A woman in the neighborhood offered me the use of her telephone. Another brought over a red flare. She said she had always wanted to light a red flare and this was the first time she had had the chance. Several people offered me a lift. Finally the tow car arrived. I told them to take the wreck and dump it on the used car lot where it came from. (Later I went back and bought another car from the same dealer.)

I drove my wife home and headed for the mountain again. By hurrying I figured I might just be able to make it. I arrived at the 100-inch to find the astronomer and night assistant wondering what on earth had happened to me. They had set the telescope on Venus. Already dawn was coming on. I had to plunge in and trust to luck to carry me through. Fortunately everything went all right. I got four spectra of Venus that were as good as if everything had gone according to plan. Only I practically tore myself apart in the process of doing it. (But you won't find any mention of it in my paper.)

Let me hasten to add that my experiences were no worse and actually not nearly as bad as many others have suffered. Every astronomer has his horror story. About the time he got a perfect 12-hour exposure and then accidentally turned on the light in the darkroom. Or put the plate in the hypo instead of the developer. Or dropped it in the sink. Or fell asleep while his plate was developing and didn't wake up till an hour later. Incidents could be mulitplied indefinitely.

So much for the personal side of the observations. What about the results?

Determining the period of rotation of a planet spectroscopically is of some interest in physical optics in that it depends upon the Doppler effect for the reflected light. In almost every other case in astronomy the Doppler effect arises from a glowing gas. Often it seems as if nature deliberately throws difficulties in a scientist's path, but in this case nature gives the scientist an assist. The situation is shown in Fig. 2. We are supposed to be looking down on an equatorial cross-section of the planet, which is rotating with a velocity V in the direction of the arrow. The rotation shown is counterclockwise or "direct." Let i be the angle at the planet between the Sun and Earth. We measure the position of the spectrum lines at the limb at P_1, and at the terminator at P_2. The position of the spectrum lines will be shifted slightly to the red and violet owing to the Doppler effect. The amount of this shift depends upon the velocity Venus-Earth *and* Venus-Sun.

In measuring the spectroscopic rotation of a planet we must be sure to include lines that give a null effect. There are a dozen reasons why the spectrum lines might be shifted owing to instrumental and other errors. I photographed a certain region of the spectrum in the orange that contains lines which originate in the atmosphere of the Earth. I *know* that these lines must be straight. Hence they were used to correct the measured position of the lines in the spectrum of Venus.

Consider light reflected from the limb of Venus at P_1. Relative to the *Earth* the surface is receding with a velocity V. Relative to the *Sun* the surface is receding with a velocity V cos i. Hence lines in the spectrum at P_1 should show a Doppler shift to the red corresponding to a velocity $V + V \cos i$.

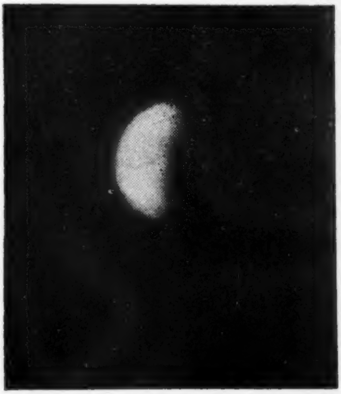
Consider the situation at the terminator of Venus at P_2. Relative to the *Sun* the surface is approaching with a velocity V. Relative to the *Earth* the surface is approaching with a velocity V cos i. Since the velocities at P_1 and P_2 are in opposite directions the total or *spectroscopic velocity* corresponds to a velocity $2V(1+\cos i)$. If Venus had a glowing atmosphere, the Doppler shift due to rotation would only be half as much. For example, if we measured the shift in neon signs at P_1 and P_2 the shift would be $V(1+\cos i)$.

One needs no more than an elementary knowledge of trigonometry to see that our best chance of detecting rotation in Venus is to observe when i is as small as possible. Thus when i is 0° the spectroscopic velocity is 4V. When i is 90° the spectroscopic velocity is 2V. When i is more than 90°, and the planet appears as a crescent, the spectroscopic velocity is less than 2V. This explains my anxiety to observe Venus the night my car cracked up. At that time the phase was gibbous and i was only 63°. Of course when i is small Venus is near the sun and difficult to observe. In fact, you always seem to be in trouble trying to observe Venus. Which probably explains why so little attention has been paid to our next-to-the-nearest neighbor in space.

The early measures on the spectra of Venus failed to give a definite rotation period. V. M. Slipher obtained a small retrograde velocity. He considered the rotation too slow to be measured by the spectrograph. The Mount Wilson observers in 1923 obtained essentially the same result. But radiometric measures at Mount Wilson made a few years later showed the dark and light sides of the planet to be at about the same temperature of —40°C. These measures were repeated recently with modern equipment but the result was the same. Evidently Venus must be rotating fast enough to equalize the temperature on the night and sunlit sides. The low temperature of —40°C presumably refers to the top cloud surface of the planet.

The null result from the spectroscopic observations might be explained if the axis of Venus is tilted at such an angle that the planet revolves in its orbit something like a barrel rolling on its side. Thus if we happened to observe Venus when its pole was pointed toward the Earth we

Fig. 4: Photograph of Venus taken by the author on March 4, 1956, through an ultraviolet filter with the 60-inch telescope on Mount Wilson. Venus is one of the hardest objects in the realm of planetary photography. The markings are diffuse and delicate and difficult to reproduce with enlargement even on the hightest contrast paper. The central markings on this print are probably seen better when viewed from a distance of several feet.



would get no Doppler shift due to rotation, no matter how fast it was turning. Back in 1921 W. H. Pickering from visual observations thought he had evidence for a rotation period of sixty-eight hours, with a rotation corresponding to a rolling motion. Two other observers confirmed Pickering's results in a general way. Now you might be unlucky enough to observe Venus at a point in its orbit when its axis is directed toward the Earth. But at other points in its orbit its axis would be nearly perpendicular to the line of sight. Also, you will have a hard time finding astronomers who put much faith in visual observations of Venus.

The fact that photographs in ultraviolet light usually show bands crossing the disk of Venus is in itself an indication of a moderate speed of rotation. Otherwise it is hard to see how markings of this kind can be explained. If Venus rotated very slowly we should expect the markings to be nearly symmetrical around the point directly beneath the sun. Instead of parallel belts they should look more like spokes radiating from the hub of a wheel.

We can get a rough determination of orientation of the planet's axis of rotation in space by assuming the cloud belts to be parallel to the Venusian equator. This has been done by G. P. Kuiper of the University of Chicago and myself. (Fig. 3.) Considering the uncertainties involved our results agree tolerably well. Kuiper's results are entitled to greater weight than mine since they are based upon more observations. But regardless of which determination we use the result is about the same. Never during my work was the axis of Venus tilted toward the Earth enough to make much difference in the measures for rotation.

The straight mean of 102 of my best observations gives a rotation period for Venus of fourteen days in a retrograde direction. This corresponds to an equatorial velocity of rotation of —0.032 km/sec, with a standard error of the mean of ±0.033 km/sec. This result may be interpreted in different ways according to the theory of probability:

a. The direction is retrograde, with the period between eight and forty-six days, with the chances 1/1. (Since Venus is the only woman among the planets we might expect her to be rotating in a direction contrary to all the others.)

b. The period is longer than fourteen days direct, or longer than five days retrograde, with one chance in seventeen of being wrong.

c. The period is longer than seven days direct, or longer than three point five days retrograde, with one chance in one hundred thirty-five of being wrong.

Thus my results agree essentially with those obtained earlier: Venus is evidently rotating so slowly that it is impossible to get a reliable value for the period with the spectrograph.

Recently a new method of attack on the problem has come to light with the discovery of radio emission from Venus at eleven meters with the radio telescope at the Ohio State University. Their radio observations were made from February to July, 1956, with April omitted, and thus overlap my spectroscopic observations. The radio emission is of an impulsive nature recurring about every thirteen days, with a distribution pattern repeated from 1.6-1.85 hours earlier on successive days. The observers at Ohio State believe the thirteen-day interval is not the true rotation period, as they consider it unlikely the activity would be repeated by a pattern advancing a fixed amount each day. Rather they conclude that the thirteen-day interval represents the beat-frequency between the rotation periods of Venus and the Earth, and that the probable value of the rotation period is twenty-two hours seventeen minutes, with an uncertainty of ten minutes either way. The radio observations do not indicate the direction of rotation.

I doubt if many astronomers will be willing to accept a rotation period for Venus as short as twenty-two hours. If Venus were rotating that rapidly, the disk should be sensibly oblate. But numerous observations made when Venus was in transit across the sun have failed to reveal any evidence of polar flattening.

There is still another way of getting at the problem. We can send a rocket to Venus equipped with some device that will transmit the desired information back to Earth. In my opinion we should work in the direction of a planetary probe and forget about manned space flight.

THE END

THE ANALYTICAL LABORATORY

I suppose it always will be a mystery to me . . . but some months, everyone decides to vote . . . and some months, we get a pretty slim bag of comments. This time, the May, 1958 issue, for reasons presumably understandable to an Arisian, drew a remarkably heavy vote. And it was a vote that proceeded to knock two large holes in the traditional pattern. 1. Longer stories almost invariably win first place. 2. Short stories almost never place high.

So an 11,000 worder placed first, and a 6,000 word short story took second. Here's the score:

(*Continued on page* 133)

POINT OF FOCUS

BY ROBERT SILVERBERG

If "you can't live with 'em, and you can't live without 'em"...you're bound to learn something in the process. The difficulty is to get someone who wants agreement to realize the value of innate, unalterable, and fixed disagreement....

Illustrated by Freas

FEDERATION Emissary Holis Bork was a confident man—and, if he felt a twinge of curious uneasiness at his first glimpse of Mellidan VII, it was not because he doubted his own capabilities, or the value of the Federation's name as a civilizing force.

He told himself that it was something subtler and deeper that twinged him, as the warpship spiraled down about the unfederated planet.

Emissary Bork worried about that subliminal reaction through most of the landing period. He sat broodingly with his eyes fixed; the members of his staff gave him a wide berth. It was, he saw, the deference due to a Federation Emissary so obviously deep in creative thinking. The others were clustered at the far end of the observation deck, staring down at the fog-shrouded yellow-green ball that was soon to be the newest addition to the far-flung Federation. Bork listened to them.

Vyn Kumagon was saying, "Look at that place! The atmosphere blankets it like so much soup."

"I wonder what it's like to breathe chlorine?" asked Hu Sdreen. "And to give off carbon tetrachloride instead of CO_2?"

"To them it's all the same," Kumagon snapped.

Emissary Bork looked away. He had the answer; he knew what was troubling him.

Mellidan VII was *different*. The peoples of the worlds of the Federation, and even the four non-Federated worlds of the Sol system, shared one seemingly universal characteristic: they breathed oxygen, gave off carbon dioxide. And the Mellidani? A chlorine-carbon tetrachloride cycle which worked well for them—but was strange, *different*. And that difference troubled Federation Emissary Bork on a deep, shadowy, half-grasped plane of thought.

He shook his mind clear and nudged the speaker panel at his wrist. "How long till landing?"

"We enter final orbit in thirty-nine minutes," Control Center told him. "Contact's been made with the Mellidani and they're guiding us in."

Bork leaned back in the comforting webfoam network and twined his twelve tapering fingers calmly together. He was not worried. Despite Mellidan VII's alienness, there would be no problems. In minutes, the landing would be effected—and past experience told him it would be but a matter of time before the Federation had annexed its four hundred eighty-sixth world.

Later, Bork stood by the rear screens, looking down at the planet as the Federation ship whistled downward through the murky green atmosphere. *To civilize is our mission,* he thought. *To offer the benefits*—

It was four years Galactic since a Federation survey ship had first touched down on Mellidan VII. It had been strictly an accidental planetfall; the prelim scouts had thoroughly established that there was little point in bothering to search a chlorine world for oxygen-type life. That was easily understood.

What was not so easily understood was the possibility of a nonoxygen metabolism. Statistics lay against it; the four hundred eighty-five worlds of the Federation all operated on an oxynitrogen atmosphere and a respiration-photosynthesis cycle that endlessly recirculated oxygen and carbon dioxide. The four inhabited worlds of the unfederated system of Sol were similarly constituted. It was a rule to which no exceptions had been found.

But then the scoutship of Dos Nollibar, cruising out of Vronik XII, came tumbling down into the chlorinated soup of Mellidan VII's atmosphere, three ultrones in its warp-drive fused beyond repair. It took six weeks for a rescue ship to locate and remove the eleven Federation scouts—and by that time, Chief Scout Dos Nollibar and his men had discovered and made contact with the Mellidani.

Standing at the screen watching his ship thunder down into the thick green shroud of the planet, Emissary Bork cast an inward eye back over Nollibar's scout report—a last-minute refresher, as it were.

" . . . Inhabitants roughly humanoid in external structure, though probably nearly solid internally. This is subject to later verification when a specimen is available for complete examination.

" . . . Main constituents of atmosphere: hydrogen, chlorine, nitrogen, helium. Smaller quantities of other gases. No oxygen. This mixture is, of course, unbreathable by all forms of Federation life.

" . . . Mean temperature 260 Absolute. Animal life gives off carbon tetrachloride as respiratory waste; this is broken down by plants to chlorine and complex hydrocarbons. Inhabitants consume plants, smaller animal life, drink hydrochloric acid—

" . . . Seat of planetary government apparently located not far from our landing-point, unless aliens have deliberately misled, or we have misunderstood. Naturally most of our data is highly tentative in nature, subject to confirmation after this world is enrolled in the Federation and available for further study."

Which is my job, Bork thought.

For four years, ever since Nollibar had filed his report, Bork had readied himself for the task of bringing Mellidan VII into the Federation. Nollibar had returned with recorded samples of the language, and a few months of phoneme analysis had been sufficient to work out a rough conversion-equation to Federation, good enough for Bork to learn and speak.

There would undoubtedly be a promotion in this for him: to Subgalactic Overchief, perhaps, or Third Warden. Of the ten emissaries whose task it was to bring newly-discovered planets into the Federation, it was he the First Warden had chosen for this job. That was significant, Bork thought: on no other world would the Emissary be forced to forego direct face-to-face contact with the leaders of the species to be absorbed. Here, on the other hand—

Bork sensed a presence behind him. He turned.

It was Vyn Kumagon, Adjutant in Charge of Communications. Bork had no way of knowing how long Kumagon had been peering over his shoulder; he resented the intrusion on an emissary's privacy.

And Kumagon's green eyes were faintly slitted—the mark of Gyralin blood somewhere in his heritage. As a pure-bred Vengol of the Federation's First Planet, Bork felt vague contempt for his assistant. "Yes?" he said, mildly but with undertones of scorn.

Kumagon's slitted eyes fixed sharply on the Emissary's. "Sir, the Mellidani have beamed us for some advice."

"Eh?"

"They'd like to know how close to the Terran dome we want to land, sir."

Bork barely repressed a gasp. "*What* Terran dome?"

"They said the Terrans established a base here several months ago. Sir? Are you well? You—"

"Tell them," Bork said heavily, "that we wish to land no closer than five miles from the Terran dome, and no further than ten. Can you translate that into their equivalents?"

"Yes, sir."

"Then transmit it." Bork choked back a strangled cry of rage. Someone, he thought, had blundered in the home office. That Terrans should be allowed to land on a world being groomed for Federation entry—!

Why, it was unthinkable!

The planet was the most forbidding-looking Bork had ever seen, and he had seen a great many. With screens turned to maximal periphery, he could stand in the snout of the ship and look out on Mellidan VII as if he stood outside. It was hardly a pleasant sight.

The land was utterly flat. Long stretches of barren gray-brown soil extended in every direction, sweeping upward into tiny hillocks far toward the horizon. Soil implied the presence of bacteria—anerobic bacteria, of course. Life had evolved on Mellidan VII despite the total lack of oxygen.

There were seas, too, shimmering shallow pools of carbon tetrachloride that had precipitated out of the atmosphere. Plants grew in these ponds: ugly squishy plants, that looked like hordes of gray bladders strung on thick hairy ropes. They lay flat against the bright surface of the carbon tetrachloride pond, drifting. As Bork watched, a Mellidani appeared, wading knee-deep, gathering the bladders, slinging them over his blocky round shoulders. He was a farmer, no doubt.

At this distance it was difficult to tell much about the alien, except that his body was segmented crustacean-like, humanoid otherwise; his skin looked thick, waxy, leathery. Chief Scout Nollibar had postulated some member of the paraffin series as the chief constituent of Mellidani protoplasm; he was probably right.

Clouds of gaseous chlorine hung thickly overhead, draping the sky with a yellow-green blanket. Somewhere directly above burned the sun Mellidan: a yellow star of some intensity, its heat negated by the planet's distance from it and by the swath of chlorine that was the atmosphere's main component.

One other distinct feature made up the view as Bork saw it. Some eight miles directly westward, the violet-hued arc of a plastic-extrusion habitation dome rose from the bare plain. Bork had seen such domes before—more than forty years before, when he had served as a member of the last mission to Terra.

He had been only a Fifth Attaché then, though soon after he was to begin the rapid climb that would bring him to the rank of Federation Emissary. On that occasion, the emissary had been old Morvil Brek, who had added twelve worlds to the Federation during his distinguished career. Brek had been named to make the fifth attempt to enroll the Sol system.

The mission had been a failure; the Terran government had emphatically rejected any offer to federate, and Emissary Brek then declared the system non-Federated for good, in a bitter little speech which fell short of making its intended effect of altering the Terran decision. The Galactics had departed—and, on the outward trip, Bork had seen the violet domes on the snowswept plains of Sol IX, where the Terrans had established an encampment.

He scowled, now. Terrans on Mellidan VII? *Why? Why?*

"Contact has been made with the Mellidani leaders, sir," Kumagon said gently.

Bork drew his eyes from the Terran dome. It seemed to him he could almost see the Terrans moving about within it, pale-skinned, ten-fingered, almost repellingly hairy men with that sly expression always on their faces—

Just imagination. He sighed.

"Transfer the line up here," Bork said to his adjutant. "I'll talk to them from my chair."

Bork sprawled in a leisure-loving way into the intricate reticulations of the webfoam chair; he nudged a stud at its base and the chair began to quiver gently, massaging him, easing the stress-and-fatigue poisons from his muscles. After a moment, the communicator screen lit up, breaking into the wide-periphery view of the landscape.

Three Mellindani faced him squarely. They were chalk-white and without hair: their eyes were set deep in their round skulls, ringed with massive orbital ridges, veiled from time to time by fast-flickering nictitating membranes, while their mouths—if mouths they were—were but thin lipless slits. Three nostrils formed a squat triangle midway between eyes and mouth, while cupped processes jutting from the sides of the head seemed to equate with ears. Bork was not surprised at this superficial resemblance to the standard humanoid type; there is a certain most efficient pattern of construction for an erect humanoid biped, and virtually all such life adheres to it.

The emissary said, "I greet you in the name of the Federation of Worlds. My name is Holis Bork; my title, Emissary."

The centermost of the aliens moved his lipless mouth; words came forth. The linguistic pattern, too, adhered to norms. "I am Leader this month. My name is unimportant. What does your Federation want with us?"

It was the expected quasi-belligerent response. Twenty years of emissary duties had reduced the operation to a series of conditioned reflexes, so far as Bork was concerned. Stimulus A produced Response B, which was dealt with by means of Technique C.

He said, "The Federation is composed of four hundred eighty-five worlds scattered throughout some thirty thousand light-years. Its capital and First Planet is Vengo in the Darkir system; its member peoples live in unmatched unity. Current Federation population is twenty-seven billion people. Membership in the Federation will guarantee you free and equal rights, full representation, and the complete benefits of a Galactic civilization that has been in existence for eleven thousand years."

He paused triumphantly with soundless fanfare. The array of statistics was calculated to arouse a feeling of awe and lead naturally to the next group of response-leads. The Federation's psychometrists had perfected this technique over millennia.

But the Mellidani leader's reaction jarred Bork. The alien said, "Why is it that the Terrans do not belong to the Federation?"

Bork had been ready with the next concept-group; he had already begun to bring forth the second phase of his argument when the impact of the Mellidani's sudden irrelevant question slammed into his nervous system and set the neat circuitry of his mind oscillating wildly.

It was a dizzy moment. But Bork had his nerves under control almost instantly, and a moment later had formulated a new pat reply he hoped would cover the new situation.

"The Terrans," he said, "did not choose to enter the Federation—thereby demonstrating that they lack the wisdom and maturity of a truly Galactic-minded race."

It was impossible to tell what emotions were in play behind the alien's almost inflexible features. Bork found himself trembling; he docketed a mental note to have a neural overhaul when he returned to Vengo.

The alien said, "You imply by this that the Federation worlds are superior to the Terran worlds. In what way?"

Again Bork's nerves were jolted. The interview was taking a very unpredictable pattern indeed. *Damn* those Terrans, he thought. And double-damn Security for allowing them to get a foothold here with an emissary on his way!

Sweat dribbled down the emissary's olive-green skin. His military collar was probably drooping by now. He rooted in his mind for some sequence of arguments that would answer the stubborn alien's question, and at length came up with:

"The Federation worlds are superior in that they have complete homogeneity of thought, feeling, and purpose. We have a common ground for intellectual endeavor and for commercial traffic. We share laws, works of art, ways of thinking. The Earthmen have deliberately placed themselves beyond the pale of this communion—cut themselves off from every other civilized world of the galaxy."

"They have not cut themselves off from us. They came here quite willingly and have lived here during three Leaderships."

"They mean to corrupt you," Bork said desperately. "To lead you away from the right path. They are malicious: unable to enter Galactic society themselves through their own antisocial tendencies, they try now to drag an innocent world into the same quagmire, the same—"

Bork stopped suddenly. His hands were shaking; his body was bathed in perspiration. He realized gloomily that for the first time in his career he had no notion whatever of the next line of thought to pursue.

Promotion, glory, past achievements—all down the sink because of failure now, here? He swallowed hard.

"We'll continue our discussions tomorrow," he said hoarsely. "I would not think of keeping you from your daily work."

"Very well. Tomorrow the man at my left will be Leader. Address your words then to him."

In the state he was in, Bork had little further interest in protocol. He broke the contact hastily and sank back in the cradle of webfoam, tense, sweat-drenched.

The pouch of his tunic yielded three green-gold pellets: metabolic compensators. Bork gobbled them hurriedly, and, as his body returned to normal equilibrium, sank back to brood over the ignominious course of the interview.

Naturally, Bork thought, the conversation had been monitored and recorded. That meant that Vyn Kumagon and six or seven technicians had been eye-witness to the emissary's fumbling handling of the first interview—and, with the interview already permanently locked into a cellular recorder, there would be many more eavesdroppers, a long chain of them between here and Vengo and the First Warden.

Bork knew he had to redeem himself.

High faith had been placed in him—but who could have anticipated a Terran counter-propaganda force on Mellidani VII? It had shattered his calm.

He would have to rethink his approach.

Undeniably, the Terrans were here. And undeniably they had made overtures of some sort toward the aliens. Of what sort? That was the missing datum. The keystone of all possible speculations was missing—the purpose of the Terrans.

Did they have some strategic use intended for Mellidan VII? That seemed improbable, in view of the world's forbidding nature. No Terran colony could survive here without the protection of a dome. Unless, he thought coldly, they meant to take over the planet and convert it into a new Earth, as they had done with Sol II, Sol IV, and one of the moons of Sol VI. That would mean the death or deportation of the Mellidani, but would the Terrans worry long over that?

Yet—why would they pick an inhabited world for such a project, when there yet remained a dead planet in their own system? Bork forced himself to reject the colonization plan as implausible under any circumstances.

Perhaps Terra had some yet unknown economic need that Mellidan VII met. Perhaps—

Bork's head ached. Speculation was not easy for him. After a while he rose and went below to seek sleep.

There was a fixed routine for the assimilation of worlds into the Federation. It was a routine developed over thousands of years—ever since Vengo spread out to absorb its three sister worlds, eleven thousand years Galactic before, and the Federation was born. The routine customarily was successful.

Growth had been slow, at first. Two solar systems the first millennium, yielding five inhabited worlds. Then three systems the second millennium, with four worlds. Eleven worlds the next, seventeen the next—

Until four hundred eighty-five worlds had been folded into the protective warmth of the Federation, nineteen during Bork's own lifetime. Only four worlds had ever refused to

come in—the four Terran worlds, approached five times without success over the preceding two centuries. And now, Mellidan VII showed signs of recalcitrance. Bork resolved to use the age-old phrases and persuasion techniques until the Mellidani were unable to resist.

Violence, of course was shunned; the Federation had outgrown that millennia ago. But there were other methods.

When the Mellidani trio returned on the following day for their meeting with Bork, the emissary was ready for them, nerves soothed, mind primed and alert. Today, he noticed, the order had indeed been shuffled. The monthly changeover in planetary leadership had taken place.

Bork said, "Yesterday we were discussing the advantages of Federation membership for your world. You suggested that you might be more sympathetic to the Terrans than you are to us. Would you care to tell me just what guarantees the Terrans have made to you?"

"None."

"But—"

"The Terrans have warned us against entering your Federation. They say your promises are false, that you will deceive us and swallow us up in your hugeness."

Bork stiffened. "Did they ask you to sign any sort of treaty with them?"

"No. None whatever."

"Then what have they been doing here since they landed?" Bork demanded, exasperated.

"Taking measurements of our planet, making scientific studies, exploring and learning. They have also been telling us somewhat about your Federation and warning us against you."

"They have no right to poison your minds against us! We came here in good faith to demonstrate to you how it was to your advantage to join the Federation."

"And the Terrans came in good faith to tell us the opposite," returned the alien implacably. Bork had a sudden sense of the unfleshliness of the creature, of its strange hydrocarbon chemistry and its chlorine-breathing lungs. It seemed to him that the stiff white face of the Mellidani was a mask that hid only other masks within.

"Whom should we believe?" the alien asked. "You—or the Terrans?"

Bork moistened tension-parched lips. "The Earthmen clearly lie. We have brought with us films and charts of Galactic progress. The Federation is plainly preferable to the rootless, companionless life the Terrans have chosen. Be reasonable, friends. Should you cut yourself off from the main current of Galactic life by refusing to join the Federation? You're intelligent; I can see that immediately. Why withdraw? If you decline to Federate, it will become impossible for you to have cultural or commercial interchange with any of the Federated worlds. You—"

"Answer this question, please," said the Mellidani abruptly. "Why is this Federation of yours necessary?"

"What?"

"Why can't we have these contacts *without* joining?"

"Why . . . because—"

Bork gasped like a creature jerked suddenly from its natural element. This sudden nerve-shattering question had thrust itself between his ribs like a keen blade.

He realized he had no answer to the alien's question. No glib catchphrases rose to his lips. He sputtered inanely, reddened, and finally took recourse to the same tactic of retreat he had employed the day before.

"This is a question that requires further study. I'll take it up with you tomorrow at this time."

The Mellidani faded from the glowing screen. Emissary Bork made contact with Adjutant Kumagon and said, "Get in touch with the Terrans. There has to be an immediate conference with them."

"At once," Kumagon said.

Bork scowled. The adjutant seemed almost pleased. Was that the shadow of a smile flickering on the man's lips?

Later that day a hatch near the firing tubes of the Federation ship pivoted open and the shining beetle-like shape of a landcar dropped through, its treads striking the barren Mellidani soil and carrying it swiftly away. Aboard were Emissary Holis Bork and two aides—Fifth Attaché Hu Sdreen and Third Attaché Brul Dirrib.

The landcar sped across the ground, through the shallow pools of precipitated carbon tetrachloride, through the low-hanging thick murk of the sky, and minutes later arrived at the violet-hued Terran habitation dome.

There, a hatch swung open, admitting the car to an air lock. The hatch sealed hissingly; a second lock irised open, and air—oxynitrogen air—bellied in. Several Terrans were waiting as Bork and his aides stepped from the landcar.

Bork felt uneasy in their presence. They were trim, lean, efficient-looking men, all clad more or less alike. One, older than the rest, came forward and lifted his hand in a formal Federation salute, which Bork automatically returned.

"I'm Major general Gambrell," the Terran said, speaking fluent Federation. The second mission to Terra had educated the natives in the Galactic tongue, and they had never forgotten it. "I'm in charge here for the time being," Gambrell said. "Suppose you come on up to my office and we can talk this thing over."

Gambrell led the way up a neat row of low metal houses and entered one several stories high; Bork followed him, signaling for the aides to remain outside. When they were within, Gambrell seated himself behind a battered wooden desk, fished in his pocket, and produced a cigarette pack. He offered it to Bork.

"Care to have a smoke?"

"Sorry," the emissary said, repressing his disgust. "We don't indulge."

"Of course. I forgot." Gambrell

smiled apologetically. "You don't mind if I smoke, do you?"

Bork shrugged. "Not at all."

Gambrell flicked the igniting capsule at the cigarette's tip, waited a moment, then puffed at the other end. He looked utterly relaxed. Bork was sharply tuned for this meeting; every nerve was tight-strung.

The Earthman said, "All right. Just why have you requested this meeting, Emissary Bork?"

"You know our purpose here on Mellidan VII?" Bork asked.

"Certainly. You're here to enroll the Mellidani in your Federation."

Bork nodded. "Our aim is clear to you, then. But why are *you* here, Major general Gambrell? Why has Earth established this outpost?"

The Earthman ran one hand lightly through the close-cropped thatch of graying hair that covered most of his scalp. Bork thought of the vestigial topknot that was *his* only heritage from the past, and smiled smugly. After a moment Gambrell said, "We're here to keep Mellidan VII from joining the Federation. Is that clear enough?"

"It is," Bork said tightly. "May I ask what you hope to gain by this deliberate interference? I suppose you plan to use Mellidan VII as some sort of military base, no doubt."

"No."

Bork had gained flexibility during the past few days. He shot an instant rejoinder at the Earthman: "In that case you must have some commercial purpose in mind. What?"

The Earthman shook his head. "Let me be perfectly honest with you, Emissary Bork. *We don't have any actual use for Mellidan VII.* It's just too alien a world for oxygen-breathers to use without conversion."

Bork frowned. "You have *no use* for Mellidan VII? But . . . then . . . that means you came here solely for the purpose of . . . of—"

"Right. Of keeping it out of the Federation's hands."

The man's arrogance stunned Bork. That Earth should wantonly block a Federating mission for no reason at all—

"This is a very serious matter," Bork said.

"I know. More serious than you yourself think, Emissary Bork. Look here: suppose you tell me why the Federation wants Mellidan VII, now?"

Bork glared at the infuriatingly calm Earthman. "We want it because . . . because—"

He stopped. The question paralleled the ones the Mellidani leader had asked. It produced the same visceral reaction. These basic questions hit deep, he thought. And there were no ready answers for them.

Gambrell said smoothly, "I see you're in difficulties. Here's an answer for you—*you want it simply because it's there.* Because for eleven thousand years you've Federated every planet you could, swallowed it up in your benevolent arms, thoroughly homogenized its culture into yours and blotted out any minor differences that might have existed. You don't see any reason to stop now. But you don't have any possible use for this world, do you? You can't trade with it, you can't colonize here, you can't turn it into a vacation resort. For the first time in your considerable history you've run up against an inhabited world that's *utterly useless* as Federation stock. But you're trying to Federate it anyway."

"We—"

"Keep quiet," said the Earthman sharply. "Don't try to argue, because you don't know how to argue. Or to think. Vengo's ruled the roost so long you've reduced every cerebral process to a set of conditioned reflexes. And when you strike an exception to a pattern, you just steamroll right on ahead. You find a planet, so you offer it a place in the Federation and proceed to digest it alive. What function does this Federation of yours serve, anyway?"

Bork was on solid ground here. "It serves as a unifying force that holds together the disparate worlds of the galaxy, bringing order out of confusion."

"O.K. I'll buy that statement, even if it does come rolling out of you automatically." The Earthman hunched forward and his eyes fixed coldly on Bork's. "The Federation's so big and complex that it hasn't yet learned that it died three thousand years ago. Its function atrophied, dried up, vanished. *Foosh!* The galaxy is orderly; trade routes are established, patterns of cultural contact built, war forgotten. There's no longer any need for a benevolent tyranny operating out of Vengo that makes sure the whole thing doesn't come apart. But still you go on, bringing the joys of Federation from planet to planet, as if the same chaotic situation prevails now that prevailed in those barbaric days when your warlord ancestors first came down out of Vengo to conquer the universe."

Bork sat very quietly. He was thinking: *the Terran is insane. The things he says have no meaning. The Federation dead? Nonsense!*

"I knew the Earthmen were fools, but I didn't think they were morons as well," the emissary said out loud, lightly. "Anyone can see that the Federation is alive and healthy, and will be for eternity to come."

"Federations don't last that long. They don't even last *half* an eternity. And yours died millennia ago. It's like some great beast whose nervous system is so slow on the trigger it takes hours to realize that it's dead. Well, the Federation will last a couple of thousand years more, on its accumulated momentum. But it's dead now."

Bork rose. "I can't spend any further time on this kind of foolish talking," he said wearily. "I'll have to get back to my base." He fingered the glittering platinum ornaments on his stiff green jacket. "And I don't intend to give up trying to Federate the Mellidani, despite your obstructions."

Gambrell chuckled in an oddly offensive manner. "Keep at it, then. Keep on mouthing clichés and giving them hollow arguments that fall to flinders when you poke at the roots. We've warned the Mellidani. Besides, they can think for themselves, and aren't impressed easily by big words and gilded phrases. They won't be suckers for your routine."

Bork was very quiet for a long moment, staring stonily at the Earthman, trying to see behind those ice-cool gray eyes. At length he said, "Is this all just petty spite on your part? Why are you doing this, Gambrell? If you Terrans don't want to enter the Federation, why don't you keep off by yourselves and stop meddling with our activities?"

"Because the Mellidani represent something unique in the galaxy," Gambrell said. "And because *we* see their value, even if you don't. Do you know what would happen if you Federated the Mellidani? Within a century you'd have to exterminate them or expel them from the Federation. They're *alien,* Bork. Totally and absolutely and unchangeably alien. They don't breathe the same kind of atmosphere you do. They don't digest the same foods. Their lungs don't work on the principles yours do. Neither do their brains."

"What does this—"

Gambrell cut him off and continued unstoppably. "They're a cosmic fluke, Bork. They don't conform to the oxygen-carbon pattern of life, and they might very well be the only race in the universe that doesn't. We can't afford to let the Federation come in here and destroy them. And you *will* destroy them, because they're different and the Federation can't abide differences that can't be smoothed out by a little deportation and ideological manipulation and genetic monkeying."

"I wish I could follow this ridiculous line of chatter," Bork snapped savagely. "But I'm afraid I'm wasting your time and mine. Please excuse me."

Sighing, Gambrell said, "You just don't listen to me, do you?"

"I've been listening. What's so important about this *uniqueness* of these people, that must be preserved at all costs?"

Instead of asking, Gambrell crisply said, "Close your right eye, Bork. You're right-handed, aren't you?"

"Yes, but—"

"Close your right eye. There. Suddenly you lose depth perception, notice? Your eyes function stereoscopically; knock out one point of focus and you see things two-dimensionally. Well, we see things two-dimensionally, Bork, all of us. The whole galaxy does. We see things through the eyes of oxygen-breathing carbon entities, and we distort everything to fit that orientation.

"The Mellidani could be our second eye. If we leave them alone, free to look at events and phenomena in their own special alien unique way—they can provide that other point of focus for us. We have to preserve this thing they have; if we let the Federation destroy it by lumping them into the vast all-devouring amoeba of confederate existence, we may never find another race quite so alien, just as we can never regenerate a blinded eye. *That's* why we poisoned their minds against you. That's why we got here first and made sure they would never join the Federation. And they won't."

Angrily, Bork said, "They will! This is ridiculous!"

Gambrell shrugged. "Go ahead, then. Speak ye to the Mellidani, and see how far you get. This isn't an ordinary race you're dealing with. Incidentally, the Mellidani leader has been listening to this whole conversation over a private circuit."

That was the final gesture of contempt. Bork surged to the door, rage clotting his throat, and stalked out of Gambrell's office wordlessly. Federation dead, indeed! Point of focus! The Federation would absorb the Mellidani, no doubt of it. They *would!*

He reached ground-level and found his aides. "Let's get back to the ship," Bork ordered brusquely. "I want to speak to the Mellidani again. The Earthmen haven't won this conflict yet."

They drove through the clinging yellow-green fog to the slim needle that was the Federation ship. As they drove, Bork cast frantically about in his mind for some argument that was new, that was not cliché-riddled and time-worn. And no answers presented themselves.

He felt panic throbbing in his chest. The first dark cracks were starting to appear on the gleaming shield of his self-confidence—and, perhaps, on the greater shield of the Federation's vaunted prestige. The Earthman's words echoed harshly in his mind. *You'll never get Mellidan VII. The Federation is dead. Point of focus. Alien viewpoint. Necessary. Perspective.*

Then eleven thousand years of Galactic domination reasserted their hold. Bork grew calm; the Earthman's words were air-filled nonsense, without meaning. Mellidan II was not yet lost. *Not yet.*

We'll show them, he thought fiercely. *We'll show them.* But the old emissary's heart suddenly was not quite sure they would.

THE END

THE ANALYTICAL LABORATORY

(*Continued from page* 119)

PLACE	STORY	AUTHOR	POINTS
1.	Special Feature	Charles V. de Vet	1.91
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THE EDITOR.

SCIENCE FICTION
SCIENCE FICTION

THE REFERENCE LIBRARY

BY P. SCHUYLER MILLER

FROM NUMENOR TO EDGESTOW

ONE of the most pleasant consequences of last year's discussion of A. Merritt was a letter from Delmar Leaming of Newton, Iowa, who conducts what must be one of the country's most unusual book columns. In a batch of clippings from the Newton *Daily News,* which he enclosed, and which dealt with writers like Merritt and Alfred Bester, was an appreciation of Clive Staples Lewis.

When Avon concluded the paperback publication of Lewis' classic interplanetary triology with an abridged edition of "That Hideous Strength," renamed "The Tortured Planet," I was impelled not only to compare the two editions but to reread the entire series: "Out of the Silent Planet" (No. T-127), "Perelandra" (T-157) and "The Tortured

Planet" (T-211). The verdict: Lewis' triology is even more remarkable than I remembered, and twenty years after its first publication, "Out of the Silent Planet" is still one of the great interplanetary adventure tales of all time. What's more, science fiction has mellowed and broadened over the years, and what I once considered out-and-out fantasy in the last two books now comes well within the scope of themes and treatment that we find commonly in today's magazines.

Let's clear away some statistics first, then get on to this theme. The author has himself handled the abridgement of "That Hideous Strength," which is very fortunate since he has cut some sixty-five thousand words out of the 459-page original. Even so, this leaves a very long book of some one hundred thousand words—and the series as a whole totals something like two hundred fifty thousand. At the standard Avon price of 35¢ a book, this is a lot for $1.05—and that quarter of a million words includes some of the finest writing in the science fiction-fantasy field. "The Tortured Planet" tells you what happened, but a great part of the richness has been hewn away.

"Out of the Silent Planet," the first book, can be read as no more than an exceptionally vivid story of adventure among the nonhuman races of Mars. I don't know where you'll find a more real and beautiful picture of life in the depths of the great gorges that we call the Martian "canals," or of the contrastingly grim bleakness of the airless uplands. Few alien races are as fascinating as the seallike *brossa* of the lowland forests, the wise *sorns* of the uplands, and the gnomelike *pfiffltriggi* who are the planet's skilled mechanics. Most fascinating of all are the almost invisible, intangible *eldila* who live everywhere and at all times.

You can stop with this book if you like, but the series is something very different—a kind of interplanetary parable or "morality" in which the author, little by little, unfolds a strange mythology which encompasses the roots of Christianity and of paganism without ever becoming offensive to the most sensitive churchgoer. This is the case, I suppose, because Mr. Lewis is a very religious man himself, a militant agnostic who has become a theological philosopher. As adventure stories, the last two books are inferior, but as adventures in mythology and religious reasoning, they are unlike anything else in print.

In case you don't know the story of the triology, and the mythical structure underlying it, I'll attempt a very sketchy summary. In "Out of the Silent Planet" we meet a middle-aged, ivy-grown English philologist, Ransom, who is kidnaped by a physicist, Weston, and a tycoon, Devine. The three men are pure stereotypes, and the plot is old and creaking, but the author's skill and the fascination of his developing theme more than makes up for these deficiencies, and for some scientific bloopers.

Ransom is carried to Mars in a

spaceship, to be swapped for gold and other wealth. Devine wants only riches; Weston wants power to send humanity seething through the solar system, over the dead bodies of the elder races. Ransom escapes, is taken in by the simple *hrossa,* is nearly recaptured by Weston, and travels over the top of the barren world to the "capital" of the planet's guardian spirit or Oyarsa—named, like it, Malacandra. Here, after a showdown in which the "true" hierarchy of the universe is explained, the three men are sent back to Earth—Thulcandra, the "silent" planet which has been cut off from the fellowship of the planets for thousands of years.

The *eldils,* it seems, are beings who might be called "spirits" in religious terms. There are many of them, and each planet has one supreme overseer. Over them all is Maleldil the Younger, the creator of worlds and beings, and somewhere unseen beyond him is presumably another Maleldil the Elder Father, who creates universes. The races under Maleldil's guardianship live in harmony and speak a common, ancient language—but Earth's Oyarsa is a "bent *eldil,*" the personification of evil, who has been shut away by his fellows to work out his malice on Earth and mankind.

In "Perelandra," the second book, Ransom is carried to Venus, a sea-world of gorgeously fantastic floating islands and friendly, happy creatures—literally, in Lewis' etymological play, an oriental "peri-land" or "fairyland." Here he meets a beautiful, naïve, green-skinned woman, and here presently comes Weston—or rather, Weston's body, possessed by the "bent *eldil*" of Earth: Satan.

What follows through most of the book is a re-enactment of the Temptation of Eve, in a new Eden, with a new creation just completed. But this Eve is not on the "silent" Earth, and she has Ransom's dogged help though her "Adam," Perelandra's man and king, has disappeared. This long scene, written early in the war years, is a grimly fascinating example of what we have learned to call "brainwashing," and Ransom saves his Eve only by a physical battle with the possessed Un-man. This leads to a long sea-chase, adventures in a subterranean world, and a final dedication in which Malacandra and Perelandra, personifications of Mars and Venus, give the new Adam and Eve domination over their world.

The final book is the strangest of the three, and the least successful. Our protagonists now are a young couple, Mark and Jane Studdock, sunken in the trivialities of a small English college, Edgestow. Weston died on Perelandra, destroyed by Ransom, but Devine is back as Lord Feverstone, a power in the college and in a mysteriously powerful organization called NICE—National Institute of Co-ordinated Experiments. Its members are a company of viciously ruthless scientists, out after power for various reasons of their own, but governed by the severed head of a Spanish murderer which is the present home of the "bent *eldil*" of Earth.

Opposing this company of evil is an even odder and much smaller company headed by Ransom, rejuvenated by his experience on Perelandra. Mark is drawn into NICE because the enemy wants his wife's psychic powers at their disposal; both forces, it gradually appears, are seeking the aid of none other than Merlin, not dead but sleeping under the college wood these fifteen hundred years, and just as full as ever of his ancient powers. Merlin is found, and there is a finale of ruthless bloodshed when the *eldils* of Mercury, Venus, Mars, Jupiter and Saturn fuse their powers in him.

Something that I had not realized until I reread "That Hideous Strength" is that in it Lewis has also woven in the mythology built up by his friend and fellow philologist, J. R. R. Tolkien, in the massively wonderful triology that last year won the International Fantasy Award, "The Lord of the Rings." For the sunken land of Tolkien's elf-lords, Numenor, is also the lost land from which Merlin's magic—or strange science—sprang in Lewis' books. The ancient, universal tongue is clearly the language of the High-elves, Quenya. And Sauron, the dark spirit of evil who strives to rule Middle-earth, is none other than the bent *eldil* of Thulcandra, Milton's Satan, Christianity's Devil. These two strange, amazingly detailed mythologies are really one.

Critics of Robert E. Howard's "Conan" yarns have carped at the way in which he mixed places and languages from dozens of races and thousands of years into his Hyborean chronicles. What Howard was doing, of course, was suggesting that in our history and in our own times there are surviving words that are memories of his "lost" age before the Great Ice. We "remember" not only Atlantis and Lemuria but Aquilonia and Nemedia and Turan and all the rest. This is precisely what Tolkien and Lewis have also done for *their* mythology of Numenor and Malacandra and Maleldil, although with a subtlety and scholarship that was beyond Howard's powers. In Tolkien's "Lord of the Rings" we have a chronicle of a little over two years, as the "Third Age" of the elf-folk ends and the Fourth Age, of Man, begins. In his long appendixes to the final volume we have the skeleton history of Numenor and the earlier ages. C. S. Lewis' mythology carries us still farther back, to the structure which gave rise to the physical solar system, to the thinking, speaking races of the planets, and to the endless balance of Good and Evil on which all myth and all religion are based.

Is it science fiction? Is it fantasy? Is it theology? You decide, after you've read it for yourself.

SPACEWAYS SATELLITE, by Charles Eric Maine. Avalon Books, New York. 1958. 224 pp. $2.75

This book was apparently the

author's first venture into science fiction—though you may prefer to classify it as a mystery. The English edition, "Spaceways," was published about 1954 and the present version has not been updated except in the title, and in a rather lame jacket blurb in which the publisher argues that the Satellite Rocket One of the story is the first *real* satellite, in spite of sputniks and Explorers, because (a) it's ours, and (b) it's intended to stay up forever.

Old or not—and I may be in a very small minority on this—I think this is the best novel Charles Eric Maine has done to date; at least, the best published here in the United States. It's not the "Arrowsmith"-type "novel of science" that some critics claim should be the only SF, but it is a book in which what happens to people is more important than whether *S.R. One* goes up on schedule.

As I said, the book is really a mystery. Barry Conway, the narrator, is sent to Silver Falls, Nevada, as security officer for the Satellite One project. In this isolated catchall of scientific humanity, he soon uncovers a tense situation between beautiful Marion Hill, wife of the communications chief, and Design Engineer Raymond Colby. Then the satellite goes into an orbit four thousand miles short of where it should have been. The FBI catches on to something that the reader has "known" all along: the rocket fell short because it was too heavy, and it was too heavy because George Hill had stuffed the bodies of his wife and Colby inside.

It's a pretty situation: *S.R. One* can't be brought down to recover the bodies, but Dr. Paul Klein, the German-born director of research, produces calculations that show they must be there. Can George Hill be convicted on this kind of evidence?

Some rapid plot twists complicate the situation, and when the smoke has cleared away, the book has raised some pretty questions of responsibility. Who or what have been responsible for the turn events take? Is it the intellectual arrogance of Dr. Klein, who refuses to listen to a nonscientist's plea for help? Is it a "laissez faire" attitude of Conway's—a man who is reluctant to stir up unpleasantness, to the point of ignoring orders? Is it George Hill's dedication to his work, that drives his wife to the consolation of whoever comes handiest? Is it Marion Hill and Raymond Colby, thinking only of themselves and bored with the desert? Is it the Washington bureaucracy, caring nothing for the people involved and anxious to garner some "firsts" in the satellite race?

Not memorable, perhaps, and fairly pedestrian, but a good job that's going in a good direction.

WASP, by Eric Frank Russell. Avalon Books, New York. 1957. 223 pp. $2.75

Here are a good story idea and a

good writer gone to waste. A strictly formula spy story is transplanted to a future, interplanetary war setting with no more attempt to make the switch convincing than pointing his ears, pinning them back, and dyeing his skin purple.

Mowry, the hero, was brought up on the home planet of the purple-skinned Sirian enemy; he speaks with a local dialect, and knows his way around. He is dropped on another Sirian world to be a "wasp," stinging the enemy as hard and as often as possible, in order to distract his attention and tie up forces that could otherwise repel Earth's attack. It's a nice idea, and someone like Robert Heinlein might have used it to make a very good book by giving us a three-dimensional picture of the Sirian culture, making it alien in pertinent details, giving the hero the job of finding the real nerve centers where his "sting" would be most effective, and tripping him up with other details that he could not know without being the Sirian he seems.

Instead, everything is cut and dried, the Sirian society is boringly present-day, and Mowry simply slogs on through a prescribed program, step by step, without ever showing any personal ingenuity or understanding. Too bad.

THE MIND CAGE, by A. E. van Vogt. Simon and Schuster, New York. 1957. 220 pp. $3.50

This is one of those lamentable puzzlers that just doesn't do anything. Certainly Van Vogt is one of our most skilled science-fiction writers; "Slan" is a classic, a couple of the original short stories woven into "Voyage of the Space Beagle" are ditto, the "Weapon Shop" books developed a good idea dexterously, and "The World of Null A" has probably aroused more discussion than anything since the income tax. Now, in this new book, he mixes together all the ingredients and — nothing.

To quote an anonymous Group Master on page 204, we have a typical Van Vogtian plot with "Wheels within wheels within wheels. . . ." Our hero is General David Marin: let's take him as Faction 1.

Faction 2 is some kind of cabal headed by a scientist, Wade Trask, who has been condemned to death for comments disliked by the Great Judge, possibly immortal dictator of Faction 3, the organized society of several centuries hence, after three atomic wars. Faction 4 is headed by the Brain, a monster computer set up in pre-war, pre-Judge days to figure out an end to war; it has now gone into hiding. Faction 5 consists of the Pripps, semi-monstrous mutants segregated for generally menial purposes, but with a strange generic memory. Faction 6 is the imperial fragment known as Jorgia, seemingly based on Stalin's homeland, which Marin is to mop up for the Great Judge—with instructions to rape the empress instead of executing her. Faction 7 . . . but why go on?

All kinds of interesting stage props and ideas are tossed into the free-for-all, but most of them never lead to anything except to compound a confusion that is never really resolved. Very early in the game, Marin finds his "self" in Trask's body—but he promptly disguises himself as himself, and goes on as if nothing had happened. This major operational gimmick has one feeble plot purpose near the end, and gives the book its name; that's about all.

The Pripps are never any more than shadows. The Jorgian campaign is far too simple to arouse more than a yawn. The flaming tendrils that creep out of a strange clock just creep around.

A girl who has been rented as a companion for Trask's last days is almost the only interesting person in the book, and she just waves and goes away.

No matter how confused and confusing Van Vogt's plots used to be, and no matter how many loose ends were left waving in your face, his old books at least gave you a strong sense that what was going on was somehow terrifically significant. That feeling hovers over something like "Null A," no matter how often or how thoroughly it's torn to bits by critics. "The Mind Cage" leaves you with no feeling at all. It's as if a jigsaw puzzle turned out to be a fine-grain photo of a blank plaster wall.

DISCOVERY OF THE UNIVERSE, by Gerard de Vaucouleurs. Macmillan Co., New York. 1957. 328 pp. $6.00

THE INNER METAGALAXY, by Harlow Shapley. Yale University Press, New Haven, Conn. 1957. 204 pp. $6.75

Neither of these books is something you'll want to buy unless you are vitally interested in astronomy. The Vaucouleurs book, however, is a history of astronomy that brings the science right down to the present work in radio astronomy, and you can recommend it to your public library. The Shapley book, on the other hand, is a technical progress report on work the author and his associates have been carrying on at Harvard for the past thirty years. (Don't ask me why Yale published it.)

"Discovery of the Universe" is a selective, non-anecdotal "Gods, Graves and Scholars" of astronomy. The author, a French astronomer now at Lowell Observatory—and our ranking authority on Mars—has given us a history of the evolution of knowledge and ideas, from the Greeks down to the present. The book points up the international nature of "pure" science—which I take to mean any science so "useless" that it isn't wrapped up in security restrictions. The men whose work is described, others whose publications are cited, add up to a cross-section of the world.

Shapley could—and I had hoped he would, when I ordered the book

—sum up our present knowledge of the Metagalaxy, that vast system of galaxies like our own, that might almost as well be called the Universe. Instead he has written one of those exasperating scientific documents which sticks strictly to his own work, passing off others' contributions with references to the literature instead of a summary, and avoiding whole areas where work is still in progress. For example, he says little about radio astronomy, since he isn't working with it.

What is here, is spelled out in tables and graphs, for the specialist to use. The general conclusions are sparse and tentative, waiting on current surveys at Palomar and elsewhere, that will push out our knowledge of the Metagalaxy to a radius of some two billion light-years.

Still, one map, on page 113 of the book, sums up for me the inconceivable scope of this research. It is a map of the half of the sky north of the Milky Way—the North galactic hemisphere—and at first glance you'd take it for a typical star map of a pretty crowded section of the sky. Instead, each dot is a *galaxy* of millions of stars—seventy-eight thousand of them, in the vast "Canopy" that is one of the major metagalactic structures in the northern sky. In our own lifetime, astronomy has made this colossal jump, from crudely estimating the size of our own Galaxy to measuring the positions and estimating the sizes, distances, et cetera, of hundreds of thousands of galaxies, organized in a super-system whose outlines may be just beginning to take shape.

Some of Shapley's generalizations may be of interest here. He estimates that in the part of space we can "see" photographically, galaxies are spaced about one million light-years apart. Most are dwarf systems of a few million stars, and Shapley's own picture of the Metagalaxy is something like the air in your room, where the evenly distributed air molecules are replaced by the ground system of dwarf galaxies, and there are occasional systems of more conspicuous galaxies which can be likened to a puff of cigarette smoke. We're part of a small system—perhaps some twenty galaxies, including the two Magellanic Clouds, the Andromeda Nebula, and its two satellites—but the great, sprawling Virgo cluster has some twenty thousand galaxies great and small, and there are even larger systems in *outer* outer Space. It's a *big* universe.

There are also some up-to-date figures on our own Milky Way system: *the* Galaxy. It's big, but by no means the biggest: about one hundred thousand light-years in diameter, with a central mass of stars and dust clouds twenty thousand light-years across and ten thousand light-years thick. A system of globular clusters and stray stars reaches out in a roughly spherical corona to some one hundred twenty thousand light-years, and may represent an original globe from which the present flat spiral has condensed. Our Sun is about twenty-six thousand seven hundred light-years from the center, near the edge of one of the spiral arms, and about one hundred light-years north of the central plane of symmetry of the whole system.

As I said before, it's a really big universe. Not even science fiction has yet hinted at how big, but I don't know what else can.

THE OTHER SIDE OF THE SKY, by Arthur C. Clarke. Harcourt, Brace & Co., New York. 1958. 245 pp. $3.95

From where I am now sitting, this is Arthur C. Clarke's best book of short stories, and just about the best book I know to recommend to that friend who needs TV and Hollywood-inspired misconceptions about science fiction shaken out of his prejudice. In showing the immense versatility of Clarke as a writer, it illustrates the powerful versatility of SF as a medium.

You may prefer Clarke in the documentary mood of his classic "Prelude to Space"—and nobody, even Heinlein, writes that kind of story better or with more deceptive simplicity. The book gives us the documentary Clarke in two sequences of six very short stories. "The Other Side of the Sky" follows the construction of the first space platforms; "Venture to the Moon" watches a three-ship exploratory expedition to the Moon—English, American and Russian. And these are not just atmospheric vignettes; they're the kind of short-short with an immensely compact plot and snapper ending—usually a scientific snapper—that the old *Liberty* magazine made famous. Why are there canaries on all satellite stations? How could a Russian scientist, on the empty Moon, shoot himself without a gun?

On the other hand, there's the kind of rich, poetic vein in Clarke that distinguished "Don A. Stuart" from John W. Campbell, Jr., back in the good old days. It's very nicely illustrated here—with plus values. This is the Clarke, in case you need reminders, of "The City and the Stars" and "Childhood's End."

There is, first, "The Wall of Darkness," as fine a wonder-of-far-places story as we've had. Trilorne is the only sun in its strange pocket-universe, tucked away in a bubble of space-time-matter. Trilorne has only one planet—and deep in the Shadow Land that always faces away from the light is the looming band of darkness that is the Wall. For contrast, "The Songs of Distant Earth" is a slight, sentimental tale about the young girl on a far, colonial planet, who falls in love with a romantic hero out of Space—but it's just as persuasively, gently real. And there's "Transcience," in which a child's footprints on a beach trace out the rise and fall of a world—and "Out of the Sun," in which scientists on the dark side of Mercury pick up an incredible, intangible Something on their radars.

As his last book of Jorkensish tall tales, "Tales from the *White Hart,*" made clear, Clarke is also a master of just plain story telling. This book has more than its share of yarns spun for the fun of it, around a gimmick or a gadget—but they're good. "The Nine Billion Names of God" tells what happens when a Tibetan lamasery buys a monster computer to help it compile a list of all the possible names of God. "Refugee" is a very simple, very English little tale that may give us outlanders a hint of what the English feel. "Security Check" is the one in which two men in black call on the little craftsman who has been making SF sets for television. "No Morning After" points out the tetchiness of interstellar communication, and "Publicity Campaign," in which well-meaning monsters visit Earth, is a lesson in the importance of timing. "All the Time in the World" is a very neat switch on Wells' old "New Accelerator," and the title of "Cosmic Casanova" gives away everything but the switch ending.

Just such a gimmick ending is at the center of the remaining story, "The Star." This won the Convention Hugo in 1955, as best story of the year. But to call it a gimmick story is to do it no justice at all, because it is a very simply, very gently told story with a basic religious theme—one of the very few in SF that treat any religious matter seriously. It earned its Hugo, and it shows, as the entire book does, how a writer like Arthur C. Clarke can make any theme and form fresh and meaningful.

ONLY A TRILLION, by Isaac Asimov. Abelard-Schuman, New York & London. 1958. 195 pp. $3.50

If you've wanted a collection of the articles, serious and not-so-serious, that Isaac Asimov has been writing for Astounding, here they are. I wish they weren't quite so exclusively from one source, because the author has also done some good articles for the *Journal of Chemical Education* that belong in the opening section. As it is, this two-chapter prelude is a little out of key with the rest of the book, except that it prepares the unwary reader for the fascinating number-juggling when our favorite biochemist gets down to business. He tosses trillions around as effortlessly as Edmond Hamilton used to juggle suns.

In contrast, the last chapters present the Asimov who is "most wanted guest of honor" at any SF convention you care to name. This Asimov is the author of that priceless parody on scientific papers, "The Endochronic Properties of Resublimated Thiotimoline" (*Ast. Sc. Fict.*, 50:120-125, 1948), its recent sequel, and the flabbergasting "Paté de Foie Gras." The publisher has stupidly changed the title of the thiotimoline papers to the utterly un-funny "The Marvelous Properties of Thiotimoline"—*not* the kind of thing I would have expected from the Henry Schuman who launched the "Life of Science" library some years ago.

The thiotimoline article is a classic; American Chemical Society chapters have reprinted it over and over. "Paté," of course, introduces a flock of government scientists to a Texan goose that lays golden eggs . . .

The meat of the book is serious. The two introductory chapters may throw you, but keep going: they're there to get you accustomed to living with big numbers. The first has to do with the radioactive elements in the Earth, where they've come from, and where they're going. The second describes the radioactivity within us.

With Chapter 3, Dr. Asimov is swinging happily along in a field he knows well. He shows us how fantastically many possible atomic combinations there are in a molecule of hemoglobin, the red pigment that carries oxygen in our blood, and how utterly hopeless it must be for chemists to solve the puzzle of its structure. Then he blithely shows how chemists used horse sense and ingenuity to discover the structure of a somewhat smaller molecule, insulin (they've gone on to synthesize it since he wrote the original article, as he might have mentioned), impossible or not.

A kind of transitional chapter presents another impossibility of numbers—the impossibility of being "normal." Then, with Chapter 6, another theme begins to unroll. In "Planets Have an Air About Them," he makes clear what is known about the birth and breeding of atmospheres. In "The Unblind Workings of Chance," it becomes pretty clear that on our kind of planet life *must* in time occur—and will never again appear spontaneously, since it destroys the conditions that created it. In "The Trapping of the Sun" we're shown the intricate process of interlocking chemical cycles that converts a small fraction of the Sun's energy into the energy of our own lives. Finally, "The Sea-Urchin and We" sets forth some of the chemical dilemmas that our physical ancestors faced as they left the sea for fresh water and the land, and how we can trace the chemical clues back to remote kinship with the sea urchins and the brittle stars.

Last of these serious papers, "The Sound of Panting" shows us a present-day scientist faced with the terrible problem of learning what is being done in his field, even in that small corner of it not wrapped up in automatic secrecy. Apropos of this, it has recently been pointed out that Russia has a large, well staffed, competent force busily reading and boiling down *all* papers, in *all* journals, of *all* sciences, for the benefit of its own scientists. Here *Chemical Abstracts,* the only close-to-complete service that is comparable, is written, edited and published by a private professional society, with funds largely furnished by industry.

Here's the best kind of popular science: not wide-eyed and whooping, but meaningful and deftly dished. I know at least one chemist who's buying it for his father, who has cherished the thiotimoline article for the last ten years. Go, thou, and do likewise.

BEYOND THIRTY and THE MAN-EATER, by Edgar Rice Burroughs. Science-Fiction & Fantasy Publications, South Ozone Park, N. Y. 1957. 229 pp. $3.00

This comment is presented for information only. There is no telling where you'll find a Burroughs collector, and this book promises to be one of the rarities, as the original stories have been. For evident reasons, neither Burroughs nor his estate has been anxious to see them revived, and this edition might be called doubly unauthorized.

According to Brad Day's "Edgar Rice Burroughs Biblio"—same address, fifty cents, and worth more than the book—"Beyond Thirty" appeared in *All-Around* magazine in February, 1916; it is one of his few stories of the future. "The Man-Eater" was in the New York *Evening World* during November, 1915; it is a typical newspaper serial of the time, and not even remotely SF or fantasy.

Because of their hard-to-find sources, the two stories have been among the rarer and more "legendary" of Burroughs items, and about three years ago someone brought out a pirated, anonymously published mimeographed edition which has been selling nicely at conventions. I bought them and couldn't read them; now I've had to. The present SFFP hard-back edition, presumably, is based on these, and it is rumored that the Burroughs family will descend like a ton of meteoritic iron any day now, making the copies in circulation nice investments.

Both parts are terribly dated, as the best of Burroughs really is not. "Beyond Thirty" was written before America's entry into World War I, and its thesis is that we never did enter, but drew a line down the length of the Atlantic at 30° West Longitude, and another in the Pacific at 175° and withdrew for two hundred years to let Europe, Asia and Africa go to hell in their own way. Meanwhile a Pan-American federation develops, antigravity is used as routine motive power, and the gentlemen of the Navy stay well inside the bounds of 30 and 175 on pain of a charge of treason.

Come the year 2137, Lieutenant Jefferson Turck is forced by sabotage and other dirty work to make for England in a small boat, with three seamen. He finds it a wilderness, overrun with magnificent tigers, lions, elephants and wolves and sparsely populated by the noble savages who are the descendants of the few English who survived a German invasion, a great plague, and a retreat to the continent. In due course he rescues Victory, heir to the Throne of England, loses her in an equally savage Germany, becomes a slave of a general in the Christian Abyssinian empire that has expanded over Africa and is moving into Europe, is rescued by civilized Chinese invaders who have taken over Asia, and so on.

"The Man-Eater" is pure nothing: a variant on the Androcle's yarn, in which a captured man-eater solves everybody's problems, involving lost papers, a villainous cousin, hired murderers, lots of lecherous leering, and what have you.

Burroughs' white aristocratic supremacy tone may have been fashionable enough at the time, but it is purely ridiculous now. The heroine of "Man-Eater" can shoot down an African porter for insubordination, and not bother to dust off her hands; the no-goods leer and sneer and sneak; Turck wins out because he is a hereditary aristocrat. How we have grown up since 1915!

IN THE WET, by Nevil Shute. Perma Books, New York. No. M-4095. 1958. 280 pp. 35¢

I don't know how I missed the original Morrow edition of this book in 1953, but I did, and you may have too—hence the full scale treatment of this reprint.

"In the Wet" is another story of the near future, by the author of the immensely popular—and from our sophisticated point of view, overrated —"On the Beach." It begins in the Australian bush country of our own time, where an old clergyman, half dead with malaria, is watching an opium-sodden old reprobate die of peritonitis amid the floods of the wet season. We are never sure whether old Stevie Figgins is telling the story of his life thirty-odd years later, as a Commander of the Queen's Flight, or whether the Reverend Roger Hargreaves, in his near-delirium, somehow "sees" ahead with the telepathic guidance of the dying man's mind. But the story itself is of the momentous events in which "Nigger" Anderson, quarter-aboriginal flier on duty in England, has an important part. It is a story in which Elizabeth II of England is a real and central character.

Nevil Shute is a fine storyteller, a flier, and a writer who can bring his characters to life when he wants to. This is a rather quiet story, almost as much so as "On the Beach," but it is completely believable where that novel of the race's last deadly dull days is not.

In Wing Commander David Anderson's world of the 1980s, England is a strangely shriveled land. Wholesale emigration to Australia, Canada and Africa has drained off millions of her population, but the country still cannot feed itself. Empty houses and factories ramble across the weed-grown fields—yet English scientists and technicians have earned respect as a small, active brain trust for the world. A bitter Labor government is trying to strip the Royal Family of its last powers and privileges, and in response Canada and Australia have presented the Queen with two of the most modern jet liners in existence, with complete crews from their own air forces, financed by their own people—her own people. Anderson commands the Australian flight, and he is soon swept up in the events that bring England and Elizabeth to a showdown.

By its nature, this theme must

mean far more to English readers than to Americans, but it is impossible not to absorb a little of the significance that the Royal Family have for the people of the British Commonwealth. Anderson's gentle love affair with a secretary in the Queen's inner circle is wholly convincing. Elizabeth, the Consort, Prince Charles become real people when we meet them. (I must confess to one naggingly unsatisfied question: where's Margaret?)

Limited interest, I suppose, but an oddly satisfying and completely workmanlike job. I hope Nevil Shute tries again.

BARGAIN SHELF

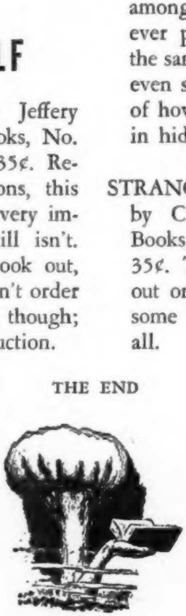
SATELLITE E ONE, by Jeffery Lloyd Castle. Bantam Books, No. A-1766. 1958. 164 pp. 35¢. Reprinted for obvious reasons, this "prophetic" book wasn't very impressive in 1954 and still isn't. The author has a new book out, but I didn't get it and didn't order it. The cover is very nice, though; hope it shows up in an auction.

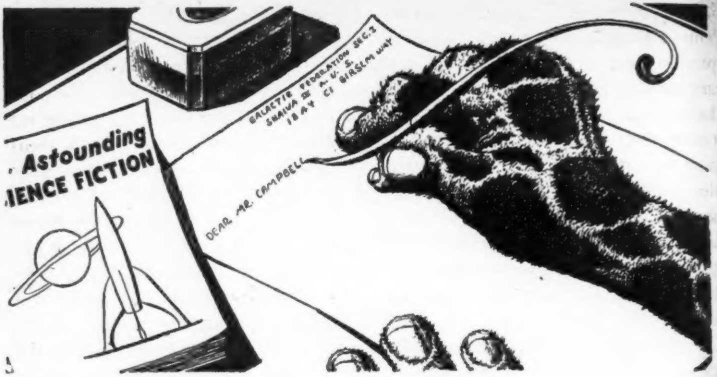
EARTHLIGHT, by Arthur C. Clarke. Ballantine Books, No. 249. 1958. 156 pp. 35¢. Technically this is an original novel, as Ballantine says repeatedly; more properly, it *was* original when they first published it in simultaneous paperback and hard editions, back in 1955. If you missed it then, don't do it now. Here's all the tension of Man on the Moon, handled by a master.

CHILDREN OF THE ATOM, by Wilmar H. Shiras. Avon Books, No. T-221. 1958. 192 pp. 35¢. The short stories which make the first two chapters of this book were among the best Astounding has ever printed; the last three tread the same ground a bit too hard, but even so it's a good buy—the story of how *Homo superior* was found in hiding and taught to grow up.

STRANGERS IN THE UNIVERSE, by Clifford D. Simak. Berkley Books, No. G-71, 1958. 190 pp. 35¢. The hard-back edition came out only last year—all good, and some very good: seven stories in all.

THE END





BRASS TACKS

Dear Mr. Campbell:

Finally a letter and subject in "Brass Tacks" to which I can add my two cents. As a mere historian—but dedicated s-f reader since discovering Astounding eleven years ago— I'm afraid much of the correspondence is over my head. But Isaac Asimov's letter in reply to that of Sprague de Camp's earlier letter is not only intelligible but also deals with a point that has interested me for some time.

In the first place, I'll agree wholeheartedly with Dr. Asimov's distinction between American and European anti-intellectualism. The distrust that exists in this country—even among persons whose professions theoretically might entitle them to be considered intellectuals—is evident in the epithets used to describe "brains" and in the concern that education for the bright students might keep them from being "real" people. One major factor in this distrust, it seems to me, can be found in our history.

Throughout most of American history, we have had as one constant the existence of large areas of free or easily available land; and the westward march of the frontier from the beaches of the Atlantic to the prairies, plains and mountains of the West where it splintered into fragments about 1890 is one of the most exciting themes of our past. There have been a lot of theories and counter theories about the influence of the frontier on American life since Frederick Jackson Turner presented a provocative paper on the subject in the early 1890s, but no one has ever denied that it did shape much of our action and thinking.

Essentially our frontier—any physical frontier—is a place of action. The need was for certain skills to protect and maintain life, then to improve the physical standard of life. Labor is at a premium on any frontier, whereas resources, whatever they may be, are relatively plentiful. Under such circumstances, "scholarly" studies are an anachronism. Book learning, apart from a possibly desirable minimum, may actually be a handicap if it requires time that should otherwise be spent in learning to make a living or defend one's life against enemies. Not until a surplus can be produced, can a society support abstract speculation, and a frontier almost by definition is rarely blessed by surplus spendable wealth. Jamestown was founded three hundred fifty years ago; the frontier line disappeared less than seventy years ago; cheap and free land continued to be available even after that date. This may not, and probably is not, the whole answer to Dr. Asimov's question, but I am sure it is part of it. And the next question is—how much inertia accumulates in three hundred years?—Elizabeth R. Seymour, 231 Talbot, San Marcos, Texas.

Also, the frontier normally forces people to learn new lessons, so that flexibility has prime survival value. But book-learning is characterized by the innate rigidity of recorded material. So, a counter-question: "How much inertia accumulates in three thousand years of book-recorded history?"

Dear Mr. Campbell:

Your editorial for March seems to have hit the nail reasonably squarely. After the Vanguard with its solar batteries, transistors, et cetera did not connect on the second try, a thing concocted by a bunch of engineers at the Redstone Arsenal did the job. Ingenuity (i.e. spinning the second and third stages to reduce the chance of failure if one of the second-stage rockets failed to fire) triumphed over the efficient application of Science.

It is also true that the people that read papers—or at least the people that write for them—do not fully appreciate the heartbreaks and frustrations involved in the operation of Herr Von Nagles's first law*. Americans are used to cars that start, radios that usually work, and reliable hot water. They expect their rockets, produced by the same technology that produces the Buick, to soar smoothly upward on a pillar of fire, a la Jupiter-C. It is perhaps gradually becoming understood that our rocket technology is in the Model T and crystal-set stage, when getting the blooming things off the ground is an achievement and pushing the button is an adventure in uncertainty.

However, I don't think that subordinating Science to Engineering is any better solution than making the Engineer a mere technician applying the Sacred Principles of Science. Many persons — including some trained as engineers—view engineering as a process of making long involved calculations and tabulations to connect a set of simplifying assumptions and approximate data with a series of highly precise answers, which are then multiplied by a safety factor and used as the basis for a design. This technique, among other things, has produced a great many highway bridges, posted for five tons, that will not fall down when a ten-ton cement mixer is driven over them. This ostensibly represents a waste of men and material in the building of the bridge; and when engineering practice is stripped of technical jargon and pseudo-mathematics, there is more of art or craft about it than profession.

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*If anything can go wrong, it will.

The leading personnel of the Manhattan Project were scientists in the much-despised European Tradition; those trained in Europe outnumbered those trained in the United States. Teller, who was mainly responsible for our having even a crude "thermonuclear device" before the people on the other side of the world, was born in Hungary. Dornberger, Oberth, von Braun, and the rest, who were mainly responsible for the machinery which launched the Explorer, are also heavily tainted with European education and scientific background.

The weakness of engineers—perhaps especially of experienced engineers—is that when they are confronted with a problem which has not been solved and which cannot be solved by the extrapolation of an existing theory or technique, they are more likely to go to great lengths to show how it can't be done than to try to figure out how it can. The classic example of this is the old chestnut about the bumblebee who absolutely cannot fly. Ideally, an engineer is concerned with finding the loopholes in the Laws of Nature uncovered by the scientist. But very few engineers survive the present American educational system, with its emphasis on co-operation and teamwork and respect for others—all of which are highly desirable human qualities in general—with enough imagination or nerve to do the job.

But such scientists as Hertz and Davy were not the mere organizers of knowledge that your editorial describes. Darwin, Newton, Einstein, and Mendeleev leaped to great general theories from scant data. A great comprehensive theory sprung on the world will usually set the data-mongers to scurrying around trying to confirm or disprove it. Other scientists, playing with new "toys," make mistakes such as Bequerel's, or discoveries like the Edison Effect, which push back the frontiers of knowledge. Was Bequerel an engineer?

It may be that our life is too well organized for such spontaneous discoveries to occur. But the Russians have at least as much of an uninspired bureaucracy hanging around their necks as we have, and their concern for the safety of their secrets is unlikely to lead them to favor unrestricted exchanges of information among scientists and engineers and informed amateurs. I cannot visualize the sputniks as the product of an eccentric millionaire and a gifted but cantankerous physicist. Although our government, regardless of which party happens to be running the administration, seems determined to try to fool some of the people all of the time, the other side with its controlled and more or less censored press is not noticeably superior.

The electric motor was invented by an obscure blacksmith in a small town in Vermont. The airplane came from a bicycle shop in Dayton. Goddard was an obscure professor at an insignificant university in Worcester. Einstein was a postal clerk in Switzerland. The atomic explosives and the extra-atmospheric rocket were produced by well-financed teams of highly educated people.

About the only common denominator seems to be the following: The people were interested in what they were doing; they believed in an underlying Order of the Universe; they believed that skillful observation and deduction could uncover that order; they believed that what they were doing was ultimately worth while for its own sake.

There is a tendency to wonder what good it will do us to have thermonuclear explosives and intercontinental ballistic missiles, to see in them only a path to the destruction of civilization and perhaps of the human race. Our scientists are worried about the consequences of placing such gadgets in the hands of political leaders concerned with their own survival. With the specter of "Thunder and Roses" on their consciences, could American physicists and missile engineers really work on their jobs with the intense enthusiasm that national security demanded. In the Manhattan Project, the results of a Hitler victory in Poland and elsewhere scared the scientists concerned into a devotion to the job of making atomic weapons. The Communists have their secret police and their slave labor and their indifference to human life, but they have not so far made human beings into soap on a large scale. Being behind may make a difference, though.

It may be argued that if our people in the missile and warhead business do their jobs well, all these accumulations of packaged destruction will cancel each other out, like the inventories of poison gas in World War II. The trouble is that, obsessed by the numerical advantage in manpower that the Soviet Union has at its disposal, we have torn up our military doctrines and reorganized our ground forces around atomic weapons. How one can profitably use atomic weapons against such favorite Communist techniques as guerrilla warfare and subversion of governments is somewhat difficult for a mind untrained in the intricacies of strategic thinking to understand. However, by thus reorganizing our tactical forces, we may be able to balance the large, modern, and impressive-looking Red Army and to prevent the Chinese from concentrating enough troops to use the can-non-fodder tactics they employed in Korea.

However, the real battleground between the United States and the Soviet Union is in the minds and hearts of men. Apart from the need for some set of rationalizations in political economy to match and overcome those of Karl Marx & Co., the relative prestige—Orientals call it "face," I believe—of the nations concerned is perhaps the most important factor. The race for the exploration of the solar system has become an important factor in national prestige. I wonder if we can afford to have this sort of thing subordinated to a purely military program.

The basic idea of separating the Vanguard from the military program is not unsound. If we were to push forward with the big engines and high-powered fuels necessary to get a space station going, the missile program could not but profit. The security impediments to information flow could be dispensed with, and the whole thing could be taken out from among the squabbling services and either let out to a civilian contractor or put under its own government agency. (I don't like "big government," but I see nobody around like the Harriman of Heinlein's stories.) Perhaps a private corporation could be organized to do the job in such a way as to get by the Securities and Exchange Commission, but some close tie to the government would probably be needed.

After the censorship screen had been removed for a while, people would begin to understand that experimental rockets are likely on occasion to blow up, and such occurrences will not cause quite so much irrational despondency. The scientists, engineers, and technicians working on the job would not have to fight their consciences to work on a nonmilitary project. They would be working toward uncovering the basic order of the Universe, and the people who were working on the space-travel program could reasonably feel that they were working for the entire human race rather than helping part of it prepare to annihilate the rest of it.

The Vanguard Project, while officially a civilian program, has in practice been an illegitimate stepchild of the services, a sort of political crumb thrown to the Navy. The project's priority has been below that of missile projects, and the taxpayers have not wasted very much money on it. Apparently we have required the Vanguard to run through the long series of trials and errors covered by the military rocket programs since 1953 without benefit of that—classified—experience. It has been deliberately designed only to put a well-designed "silly bauble" into a temporary orbit, not to push back the frontier of spaceship design. The satellite itself, which was designed to expand scientific knowledge, is of notably better design than the Sputniks or the Explorer. The fault is in the rocket, not its cargo.

Now if we were to set our scientists and engineers going on a rocket motor with a thrust of several hundred tons, a motor much too large for economic use on a missile. . . .—William F. Hoey, III, 314 William James Hall, Harvard University, Cambridge 38, Massachusetts.

The great innovators are neither scientists nor engineers, but Natural Philosophers. They seek to reduce that Which Works to Consistent Law. The Engineer, however, because he is interested solely in that Which Works is prepared to accept and use something which he cannot understand. For him, "It works" is what makes Science valuable—not its logical consistency!

Dear Mr. Campbell:

I was running through some recent copies of your magazine and I noticed that no one had yet sent in the Harvard Law of Animal Behavior for your collection of Unwritten Laws. This great universal law was first called to my attention by buddy George Lawrence and was discovered independently by scores of psychologists and what-have-you who have worked with experimental animals. It is this:

Animals will do darn well what they please. This law was proved conclusively by the following great experiment: A mouse was placed in a maze with three possible paths. One led to a piece of cheese, one to a pan of water, and a third to a female mouse. The mouse chewed its way out and escaped.

There is something else I wanted to get off my chest. In your March editorial, you stated that engineers should come before scientists. I disagree with this. Actually the two fields have nothing to do with one another except as undergraduates they may study the same courses. The purpose of scientists is to form theories and make measurements. The purpose of engineers is to make and design useful items. Engineers can get along without scientists and so can scientists without engineers. A great example of the latter is the great scientist Ohm. He performed his experiments long before any engineer had produced an efficient way to draw wire, so he did it himself.

I do agree, though, that Truman should have assigned the H-bomb to the engineers. That's their purpose, to make things. The scientists are probably quite satisfied with the fact that they discovered the neutrino with the Savannah River plant. It would take something as big as Savannah River to discover something as small as the neutrino, and this way Uncle Sam paid the bill. Besides, I'm perfectly content with the idea of having the slide-rule boys make the big bombs. I'm a physics major at the University of Utah and somewhat of a pacifist, so I'd rather not have that on my conscience. (I keep hearing a voice saying, "Larm, you're a hypocrite!)

Another thing you mention often is the fact that America has a tendency toward anti-intellectualism. Actually, there is a section of this nation which is definitely pro-intellectual, and that is the part inhabited by members of the Church of Jesus Christ of Latter Day Saints. (Us Mormons.) Our leaders are constantly telling us to learn all we can. We believe our status in the hereafter is partly determined by how much we learn. Consequently, Utah produces the most scientists in proportion to its population. In fact, if all the states produced scientists as fast as Utah, we would be way ahead of Russia.—Allan Larm, 1070 Elgin Avenue, Salt Lake City, Utah.

Hey! If those statistics are correct, let's study how Mormons train their children; they have both democracy and effectual scientific education—and aren't atheistic!

Dear John:

The "Stupidtheorem" is derived by taking a problem in instrumentation theory and rephrasing it. They all are derived from the following assumptions:

A1: The universe is a carrier of information.

A2: Information is transformable.

A3: Information is not conserved.

A4: Invariance is the same kind of thing as a law of nature.

These plus the rules of transformations of point sets and the definition of probability as the ratio of measures. When the quantum of information is defined as the least distinction the field of study is fairly well covered.

If you then ask how it is possible to map the universe of information onto a subset of itself, you are beginning the exploration of a wide set of problems. The "Evolutionary Form" as an organic subset engaged in this process can lead to the rules of behavior of organisms.

In a society which exhibits character, which is renaming invariance, there must be rules of replacement of the old by the young. This can give insight into the social relations such as kinship.

In brief when the general study is made, and it is simple, those whimsical laws of Finnagle, Bougerre, Diddle, and Murphy become accurate expressions of problems in the transformation of information, the search for the inverse, and the attempt to construct the rules of invariance, as well as some observations concerning them. This is in a sense a new frontier, open to all, and full of promise for understanding.

STUPIDTHEOREMS

1a. The probability of predicting correctly in total ignorance is zero.

1b. In total ignorance, try anything.

2. The only thing you can learn is something you don't know.

3a. You can't tell a man something he doesn't understand and expect him to make use of it.

3b. In order to tell a man something, you must speak *his* language.

4a. The probability of learning something from someone who only agrees with you is zero.

4b. The probability of learning anything *new* in a total dictatorship is almost zero—although a great deal can be accomplished.

5a. The probability of accomplishing anything with someone who only disagrees with you is zero.

5b. The probability of accomplishing anything in total anarchy is almost zero—although a great deal can be learned.

6a. If there are a number of ways to attempt accomplishment each of which is futile alone, and a non-futile combination of them, there is a best combination.

6b. There is an optimum amount—which varies with the circumstances—of agreement and disagreement for any society which is to progress both in learning and accomplishment.

7a. Since *only* thinking about a task accomplishes nothing useful

b. And action without thought accomplishes nothing useful

c. But with some thought given to the action, useful tasks can be realized,

d. Then there is a best combination of thought and action in the accomplishment of any task.

8a. An experiment never turns out wrong

b. Although it may not produce what was intended

c. Or what was expected

d. It always does what it was built to do—which may not be what the design called for.

9a. All fundamental discoveries must be made by accident.

9b. If an experiment produces unexpected results, it offers an opportunity to learn.

10a. If an experiment turns out exactly as expected, nothing can be learned from it.

10b. Although your confidence can be boosted.

11. If you do something totally new, the probability of it being understood is zero.

12a. In order to solve a problem, you must first recognize that it exists.

12b. In the absence of ignorance, no advances can be made.

13a. In order to understand a message or situation, you must be able to return the information to its source.

b. The probability of complete understanding is zero.

c. If a message source is to be understood, it must be consistent some of the time.

d. The probability of any message source being totally inconsistent is zero.

e. Continued experience is necessary to understanding.

14a. Any sequence of identical experiences is equivalent to a single experience—except for confidence.

b. Any sequence of distinguishable experiences has the character of time.

c. In the absence of change, no time elapses.

15a. A trip to a new place usually takes longer than the trip back.

b. And a child's year is longer than an adult's year.

c. And the observant man lives longer in a day than the nonobservant man.

d. But the habitual trip takes no time.

16a. The probability of learning from the completely familiar is zero.

b. So far as learning is concerned, the completely familiar is a vacuum.

c. The completely familiar figure does not exist in time or space so far as information is concerned.

d. If you don't accept information from your wife, she is likely to disappear.

e. If you don't keep your wife informed, *you* are likely to disappear.

17. In the absence of a difference, no change is possible.—Wayne Batteau.

A "Stupidtheorem" has to do with problems of learning; "stupidity" is not related to "wisdom"—the opposite of "wisdom" is "folly," not either "ignorance" nor "stupidity." "Stupidity" is the inability to learn; "ignorance" is lack-of-data,

What, then, would be the study of the problem of Unlearning? That's the great, un-investigated problem area! How do you get someone to unlearn something he knows . . . when it's wrong?

Dear John:

William C. Boyd's article in the April issue brings to mind another well-documented error which ASF corrected three years ago, and the United States Navy corrected fifteen or more years ago, but is still going strong.

Although I have seen no fictional use of an oxy-helium breathing supply to prevent "space bends" since ASF printed "Hold that Helium" in March, 1951, it seems the Air Force scientists have not wised up along with the fiction writers! I quote from a very exciting article, "My thirty-two hours at the Edge of Space," by Major David C. Simmons with Don Schanche, from *Life* magazine, reprinted by *Reader's Digest* in November, 1957.

"Circulating inside the capsule was a mixture of oxygen, helium and nitrogen. As I breathed this mixture, it flushed the excess nitrogen from my blood stream, thus protecting me from an attack of 'the bends' in the event of emergency decompression at high altitude."

The ironic thing about this is that the safe reduction ratio with nitrogen is 2.0 or 2.5 to 1, while the safe reduction ratio with helium is only 1.7 to 1. So the likelihood of bends was increased rather than decreased by the entirely needless addition of helium. Furthermore, in ascending from a deep dive with oxy-helium, the practice is to flush the *helium* out of the blood stream at sixty foot level with 90% oxygen, to prevent bends!

This information is to be found in the United States Navy diving manual, an unclassified publication to which one might suppose the Air Force scientists would have access. But evidently they preferred to get their misinformation from space writer C, who got it from space writer B, who in turn got it from space writer A, who learned from the Navy manual that divers sometimes use oxy-helium but not why they use it, and somehow missed the very clear statement, "It is desired to emphasize that a diver can contract bends when using oxy-helium mixtures as readily as with normal air."

The purpose of oxy-helium in deep diving is to prevent nitrogen narcosis at pressures of over six atmospheres, which obviously has nothing to do with high altitudes or space.—Sylvia Jacobs, 2523 S. Cabrillo, San Pedro, California.

The Air Force evidently doesn't keep track of what the Navy does!

Dear Mr. Campbell:

The following is a resumé of my findings with the Hieronymus Machine, Symbolic Type II, as described in the February 1957 Astounding. But maybe it isn't *that* machine I have been working with, for because I misinterpreted the printed directions, I "invented" something new . . . totally by accident. This, then, was Psionic Machine, Type III.

The actual circuit is the same as that printed on page 67 of the February ASF. However, Psionic Machine III uses no samples to create tactile sensations, Also, it uses metallic sensor plates for best results.

Here is a summary, as of March 2, 1958:

Psionic Machine, Type III (Modified Type II) produces

1. "hot" sensations.
2. "cold" sensations.
3. "hot-cold" sensations simultaneously.
4. "buzzyness."
5. "tackyness."
6. "tingling."
7. "throbbing" or "pulsing."
8. "stiffness" in the hand being stimulated.
9. "undulating" or "rolling" sensation in hand.

Needless to say, some of these reactions may be one and the same, but since I have found no meter to read the output, I have to rely on individual descriptions by the operators.

Machine output may be altered by

1. connecting an actual (not printed) variable (BC, e.g.) condenser across the printed condenser and tuning the former. Output level varies by tuning.
2. sketching a transformer (in schematic form) and connecting it to the Machine's output "leads" and to the sensor coil. When connected as a step-up transformer, output seems to increase, and v.v. (This may not be transformer action at all, but some kind of condenser action produced by the separated winds of "coil turns.")
3. shorting parts of the circuit out by metal, or by pencil lines.
4. placing two magnets—like poles nearly touching—near the plastic "prism." Output seems to drop greatly, or even to zero level.
5. shorting the printed condenser

with a metal object. Output stopped.

6. shorting out the threads leading from the Machine output to the coil. Output zero.

7. varying sensor plates. (I used metallic plates mostly, but other materials also worked.)

8. radically changing components' mutual relationship in the circuit. No output.

9. reversing the lead connections to the coil.

10. connecting several Machines in parallel (all to the same sensor coil). Output seems to increase when each Machine is "resonant."

No change in Machine output by

1. changing number of turns of the plate coil.

2. changing size of components (with possible exception of the printed condenser).

3. removing the "battery" from the circuit.

4. varying size or thickness of the "prism." (I believe an optically opaque "prism" works as well as one that is transparent.)

There seem to be two "resonant" points on the rotation path of the prism. Occasionally someone will receive a reaction in a new dial position, but he will receive paresthesia consistently at that position.

The Machine works over the telephone! If the telephone instrument is placed on the sensor coil, and the prism tuned to "resonance," the subject on the other end of the telephone line will feel a sensation in his hand when it is placed on his telephone's dial . . . if the subject is sensitive. There seems to be a time lapse of several seconds between "resonance" and the reported reaction. (And this is all I have been able to measure with regard to this mystic Machine!) Maybe the "radiations" of whatever aren't electrical in nature? Then what?

Especially sensitive subjects report feeling sensations several feet above the sensor plate. Others report reactions when the "radiations" are beamed across a room, *sans* wires (or threads), like microwaves.

As an addendum, I mention (this is all I can do at present) another modification of the Type II Machine. This may be the fourth type.

This version is nearly identical in circuitry to Types II and III, except that this model uses *no* prism. A metallic object brought in proximity to the circuit creates paresthesia in the subject's hand when it is on a sensor plate.

None of my findings is conclusive: they're only *indications* . . . of what, I'm not sure. The only thing I am certain of is that the Machine *does* do something. It works. But it is difficult convincing someone of this, when I cannot prove it, scientifically, to his personal satisfaction.

Does anyone have a meter for a Psionic Machine?—David M. Dressler, K6MLE, 6835 Peach Avenue, Van Nuys, California.

Maybe we should call this one the "Giraffe Machine." "There ain't no such animile!" . . . even when you're looking at it.

(*Continued from page* 7)

malian species can be bred for special characteristics; what men have done with dogs, horses, and other animals is rather incontrovertible evidence that selective breeding can, and does, produce marked variations of type.

Is Man a mammalian species or not?

There are sports, mutants, among other species. Only a hyper-democratic philosophy could maintain that there aren't among men, too!

The essence of hyperdemocracy is the denial of the right to difference—the *denial of individuality*. In that, it is the exact reverse of true democracy; democracy insists on the importance of the rights of the individual. Hyperdemocracy, in essence, says "The rights of the individual are sacred . . . but there aren't any individuals, because we're all just alike."

"Togetherness" . . . "belonging" . . . "conforming" . . . "adjusting to your environment" . . . these are all denials of the propriety of having individuality.

The United States has, I suggest, fallen for that philosophy, hook, line and sinker. And it's sinking us. Our educational system is accepting the philosophy of the convoy—"Proceed at the maximum pace of the slowest member" — with disastrous results. "Togetherness" is a fine idea . . . but not when it means slowing down the class to the pace of the high-grade moron that happens to be the slowest member. Mustn't drop the incompetent back a grade; it might damage his precious ego.

Yes? What's the resultant crawl doing to the egos of the stultified bright students?

When a "Social Studies" teacher assigns *three* pages of text, for studying every *two* days, in a sixth-grade class . . . whose precious, incompetent ego is being protected? And at what cost?

And what's with this "Social Studies," anyway? They used to call it Geography, and History, and Civics, make it three courses, and require that the students learn something, or get dropped back a grade.

So its a painful shock to a child to be rejected from his group! So what? If he's earned it, why should not he get a boot in the rear? He's going to get some rugged shocks when he gets out of that educational system!

Or . . . wait, maybe he isn't. They're certainly doing everything possible to make the real world of adult work just as cushioned and protected as that cockeyed educational hothouse. Advancement in a job isn't to be determined by individual ability, but by seniority. It isn't fair to advance a young man over twenty others who've been with the company for a dozen years of faithful service just because the young man happens to be a clear, quick, fruitful thinker, and accomplishes things, is it? Would it be democratic to let a young man develop his individual abilities like that, at the risk of injuring togetherness? No . . . in our adult world of real work, we're rapidly installing the principle our schools have established; each individual must be promoted with his class, incompetence to the contrary notwithstanding.

But the shock is coming just the same. Those nasty Communists in Russia have the idea that they can overtake the United States by setting the pace not at the convoy pace of the maximum speed of the slowest—but at the maximum speed a working quorum can maintain. Hard on the slower ones, of course . . . but it'll be even harder on other nations, won't it?

There seems to be a basic law of the Universe that is correctly and accurately expressed in our Declaration of Independence in saying that among the inalienable rights of Man is the right to the *pursuit* of Happiness. The framers of that document had more sense than our modern educational philosophers; they did *not* say that a man had a right to Happiness.

The law of the Universe seems to be, "You have a right to try anything . . . but that doesn't guarantee the right to succeed!"

From the hyper-democratic viewpoint, unusual achievement is *de facto* proof of antisocial behavior. It is not proper for any individual to achieve markedly more than his neighbors by ability; only lucky accidents—which could happen to anyone—are tolerable, because they are un-earned benefits.

If you doubt that is the present philosophy in the United States, notice how it is embodied in the income tax laws. A "tax" of ninety per cent or more is not a tax—it's a confiscatory fine. It's a punative measure, intended to make the culprit cease and desist. Which any relatively sane individual would, of course, do. The present income tax laws are designed to prevent any individual *earning* by his own productive efforts, any great economic power. Any great economic reward for outstanding ability. He is punished for insisting that he has exceptional talents that *earn* reward—insisting on it by that most obnoxious of all methods, demonstrating the ability.

However, it's not antisocial to get rich by a lucky accident; it's *earning* advantages that's obnoxious. If they accidentally happen to you, that's not antisocial. Therefore the capital gains tax is a true, reasonable tax—about twenty-five per cent. Thus if you are lucky, and accidentally discover an oil well, and make ten millions or so, that isn't *earned* income, and you aren't punished for it. There's only a twenty-five per cent capital gains tax.

If, however, you make an invention, and license the invention to many companies, and the invention is of great value so that your royalties amount to $10,000,000—that's antisocial. It's well-earned income, and is punishable with a ninety per cent fine. That's what you get for trying to be smart, instead of merely lucky.

There is, of course, the fact that patents represent an effort to achieve an advantage by being smart, by thinking out problems and devising ingenious solutions. That, obviously, is anti-hyperdemocratic, and would be attacked in a hyperdemocracy.

A patent is a license to sue; it's a government-granted right to a time-limited monopoly, enforceable by the courts.

If the courts show a consistent record of enforcing that monopoly, a consistent record of validating the concept of patents, protecting the inventor, the tendency to violate a patent will be small. But if the courts show an acute disinterest in protecting the inventor's rights, if they usually disallow patents brought before them, patent-violators have little reason to worry, and a strong temptation to violate the inventor's patent.

The record of the United States courts over the last two decades indicates that an inventor can, generally, expect his patent to be invalidated if it is brought to trial. Bringing it to trial is extremely expensive, and offers little probability of eventual reward.

The result is that patents aren't of much value to individuals; only large, well-heeled corporations can afford to use the pressure of legal harassment to make their patents work.

The Department of Justice is equalizing that situation, however. The Bell Laboratories and IBM, two of the greatest industrial research and development organizations, have already been forced, by anti-monopoly suits, to surrender their patent rights. The Justice Department is currently gunning for RCA.

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There's a lot of wild hullabaloo about the United States educational system, currently. Well, the nation is, after all, a democracy in the sense that the votes of the majority determine what shall be done. The clear vote of the majority over the last decades has been "We don't want leaders who show us what we *need;* that's frequently uncomfortable. We want servants who give us what we *want.*"

People *want* the proposition "My little Johnny is just as smart as anybody else, even if he is somewhat of a moron," to be validated. They wanted it, and they got an educational system based solidly on that postulate.

They did not want an educational

system based on the proposition, "Those who can't think, can't graduate." That was the type of system we did have. It made a lot of people unhappy. And that's terrible, of course, because most people know that the Declaration of Independence guarantees us the right to Happiness, doesn't it?

No, it doesn't. The right to try *and fail* must be protected just as rigorously as the right to try and succeed.

We've tried to wipe out the right to fail . . . and have very nearly wiped out the right to earned achievement.

I was looking over a current Social Studies textbook; in it there is a recitation of the characteristics that made America great. One that interested me was "Americans Will Try Any Job."

The Pilgrims tackled a big one, when they tackled the howling wilderness of New England . . . and they won. George Washington and his fellow rebels took on the greatest military power of the time, and won. Pecos Bill, and Paul Bunyan were willing to tackle anything—as were the cowboys and lumbermen of that era.

The United States of today, however, got the atomic bomb first largely because of a highly arbitrary, authoritarian, one-man decision by Franklin D. Roosevelt—who took an immense chance in tackling that job.

We got pushed into tackling the hydrogen bomb, out of pure fright. We knew that the Russians were taking on the job.

We didn't tackle the satellite problem—we teased it.

You can cite history to show that America is a great, courageous nation, willing to tackle the big jobs, and fight its way through.

Yes . . . but that's the history of what our *fathers* were. What's the son like? You're not citing *our* achievements when you cite history—you're citing someone else's achievements.

What have we done lately?

That's a big set of oars old Pop carved out; we can't rest on things that size! And it looks like Son is a delicate flower, who must be protected from the cruel shock of getting his ears slapped down when he muffs a job, or being passed over if he's incompetent.

We've gotten so hyperdemocratic, we've gone full circle. The individual's rights are sacred . . . except for the right to be an individual, which is antisocial.

No one has a right to be different. He must be adjusted until he conforms, and appreciates togetherness.

Personally, I can't feel the slightest sense of togetherness with dopes. Nor do I feel I have an in alienable right to inflict my presence on geniuses.

And I don't like hyperdemocracy a bit better than tyranny; each denies the most important of all individual rights—

the right to be an individual!

THE EDITOR.

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Everyone spoke of their peacetime mission,
Till somebody came and opened the door.
There they were, in a neutron fog,
The Codrogen Cat and the Hybalt Dog;
They mushroomed up with a terrible roar —
And Nobody Never was there — Nomore.

2.

Solomon Grundy
Walked on Monday
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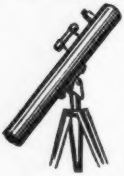

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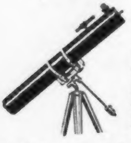

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